THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LX. No. 1537.] LONDON, OCTOBER 25, 1892. [44TH YEAR. PRICE 6d.

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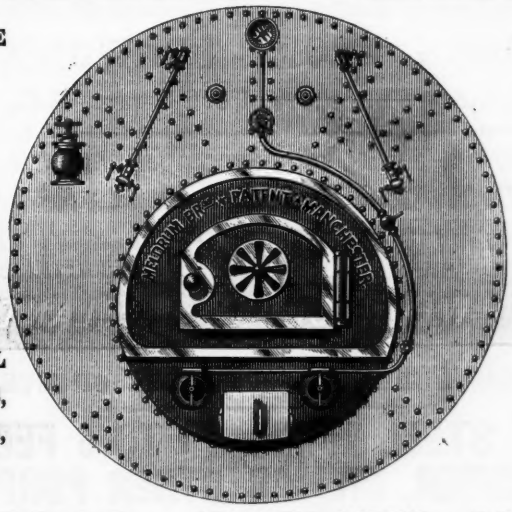

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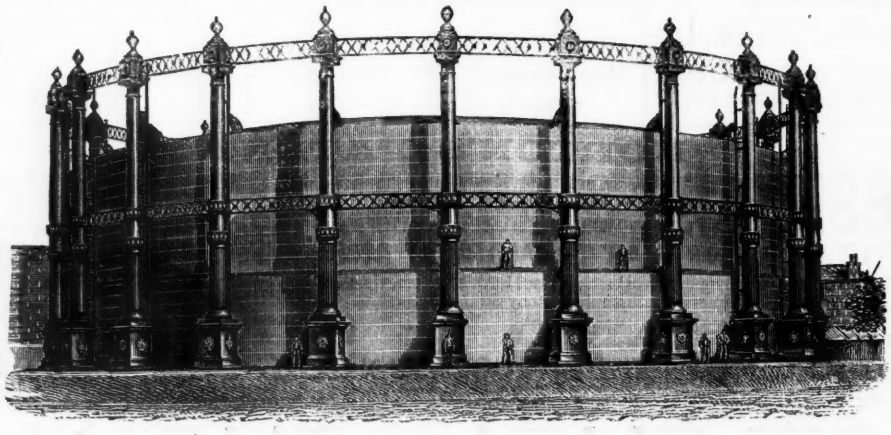

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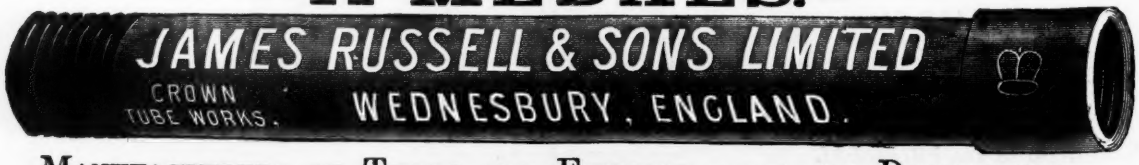

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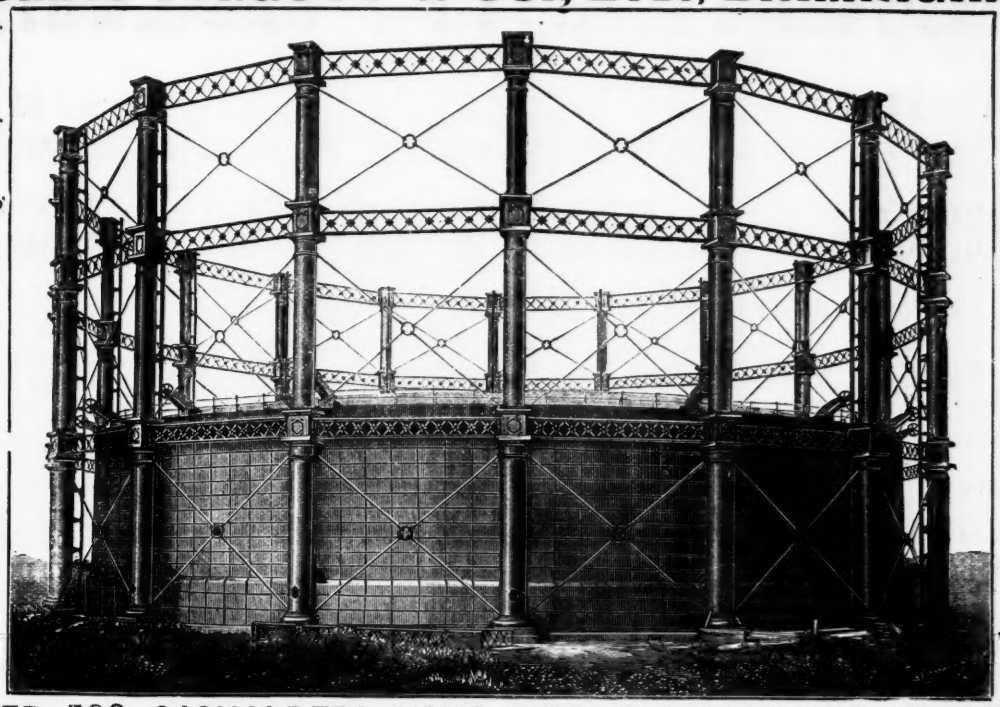

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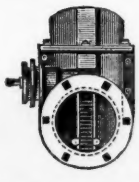

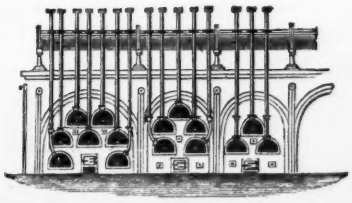

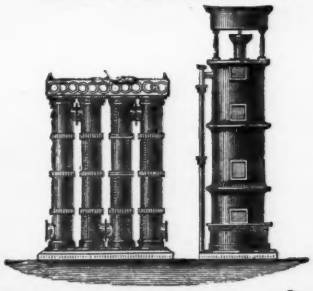

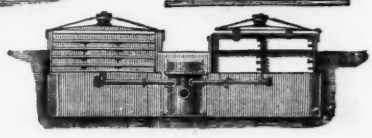

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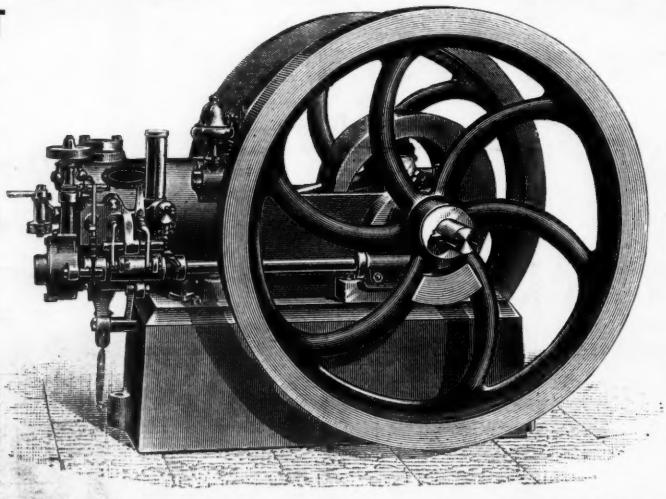

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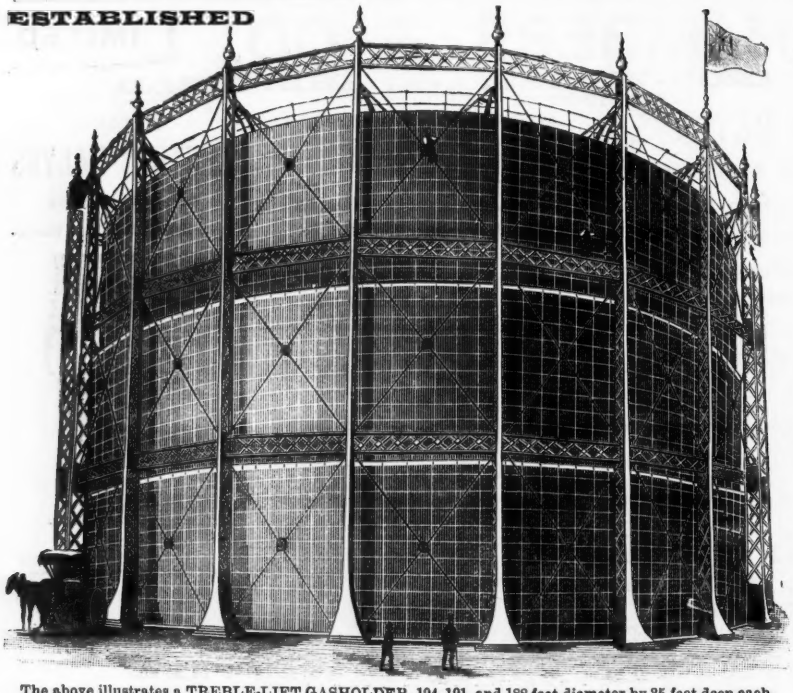

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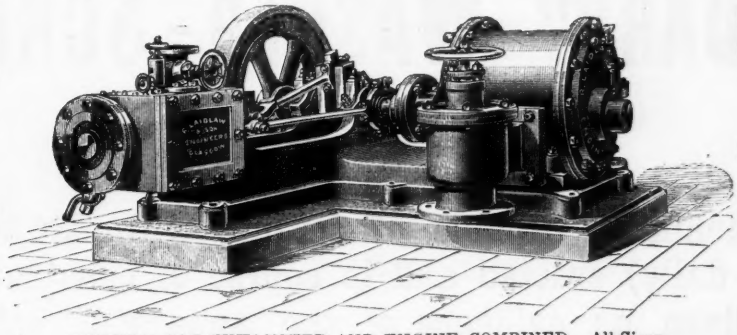

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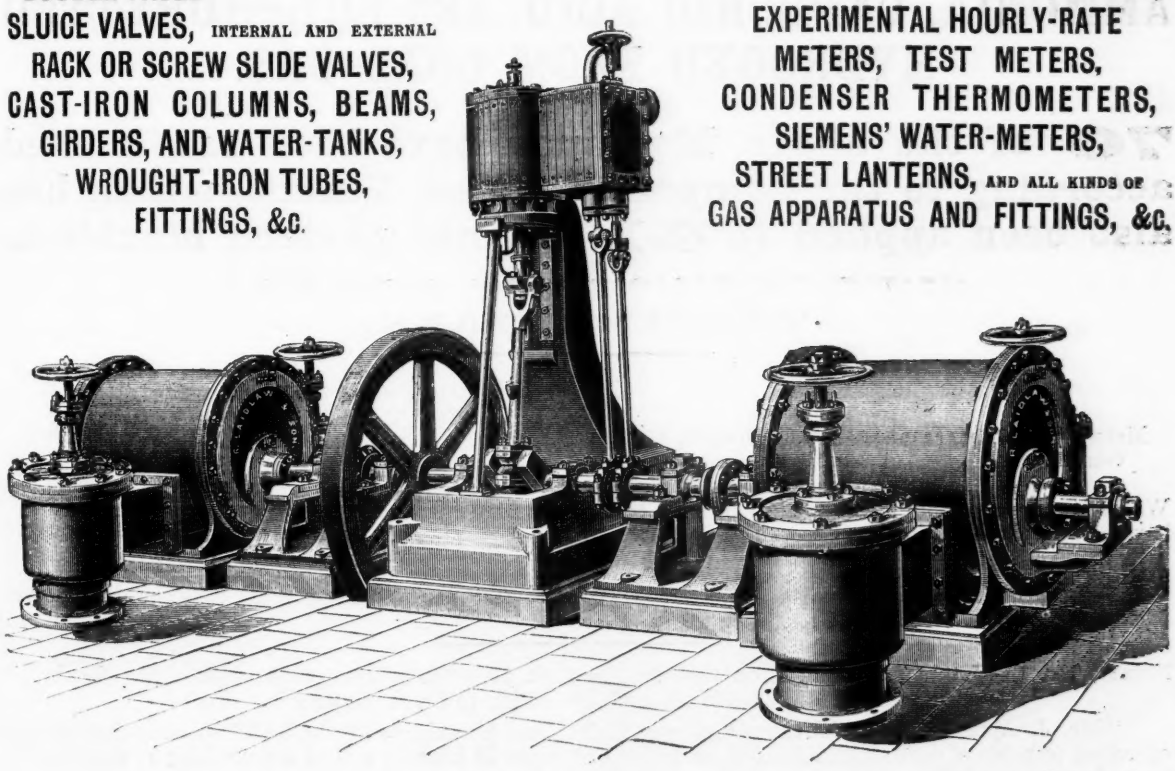

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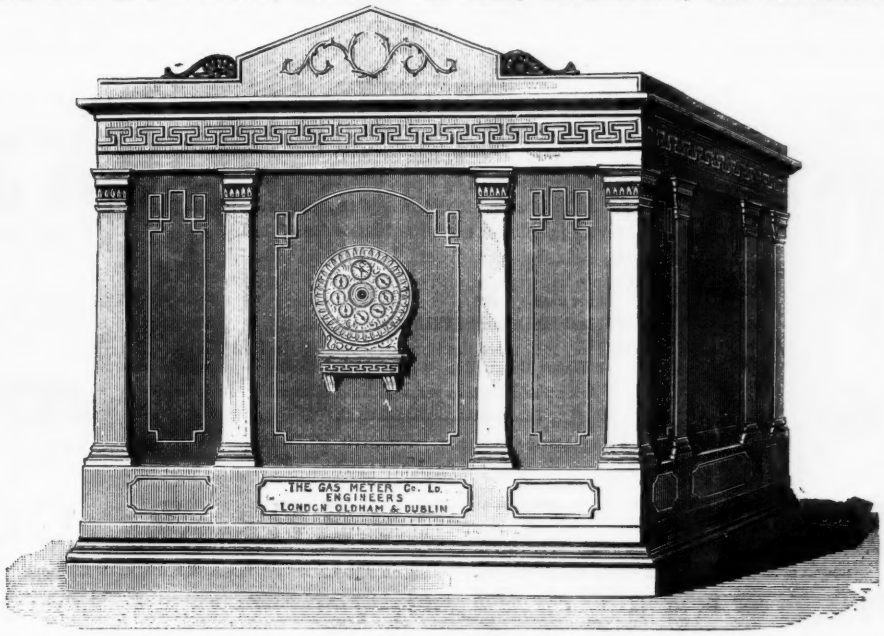

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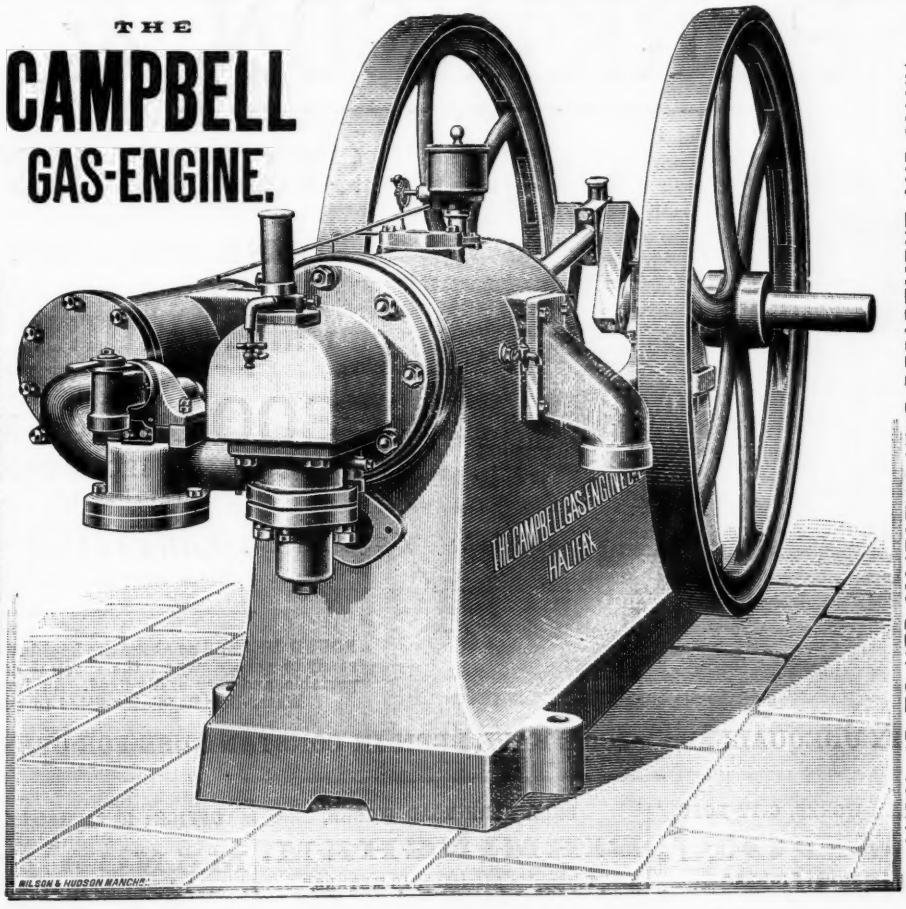

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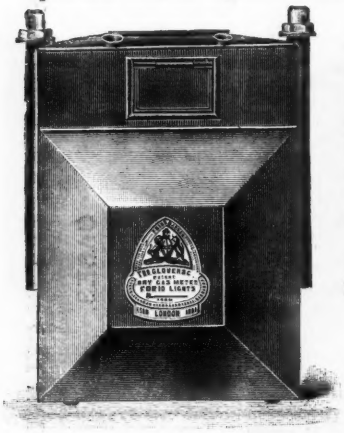

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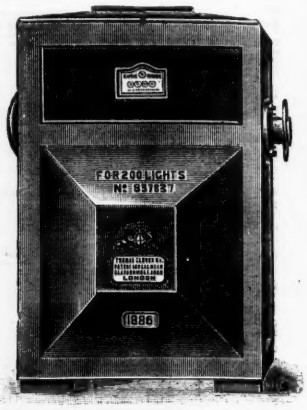

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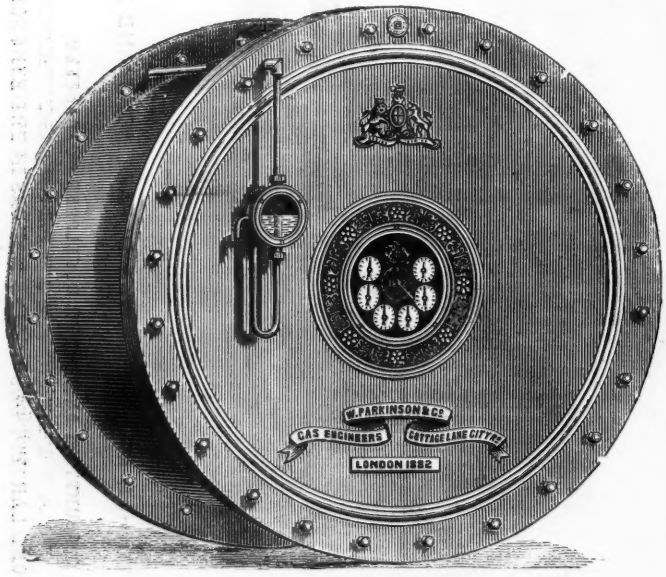

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 25, 1892.

The Wail of the Gas Consumer.

THE agitated condition of various Local Authorities and Ratepayers' Associations in different parts of the country, in face of the unwelcome necessity under which some Gas Companies find themselves of being compelled to raise the price of gas, brings to mind a certain homely lesson in human nature which has more point than many pompous essays. "Mother," asked a little girl whose thoughts must have been driven inward by some unusually unpleasant experience, "how is it that I don't "like what I don't like so much more than I like what I do "like?" It is one of the insoluble problems of life, and is in course of being illustrated by the protests and indignation meetings which we read about as marking the rise in the price of gas in such widely separated places as Preston and Brentford. This appears indeed to be one of those touches of Nature—in the region of the pocket—that "makes the "whole world kin." Yet these manifestations of popular discontent do not reflect any credit upon the brains or the hearts of those who foster or participate in them. What do these blatant malcontents care for the circumstances which, in the great majority of instances, have constrained Gas Companies to take a step the unpopularity of which they fully recognize? In most cases, dear coal, a glut in the residuals market, and the higher cost of labour had drained the Gas Companies' cash-boxes long before they resolved upon the heroic method of asking more money for their staple product. It is quite possible to take high ground in this matter, and contend that no trade, protected by statute or otherwise, would have suffered so sharply as the gas industry has done for so long without seeking the most obvious means of getting relief. Indeed, it is only necessary to compare the trade in gas with other trades to see that this contention is justified. Take the familiar example of the humble, necessary loaf of bread. How long does the baker wait after the price of wheat advances before he puts up his charge by the farthing or the half-penny per "half-quartern," which is such an outrageous commentary upon the shilling or two a quarter by which it is supposed to be rendered necessary? What of the action of retail coal merchants everywhere, when the miners only talked about raising the cost of coal at the pits by depleting stocks? Compared with such instances, the Gas Companies have really been the most self-denying of retailers; for they waited not merely for the cost of their raw material and labour to go up, but generally spent all their disposable savings in carrying on their business, before taking to the last resource of increasing their selling price. We do not claim any special credit for them on this score, but only cite the truth in support of the contention that the increases in the price of gas of which some localities complain are not the wilful, high-handed exactions of selfish monopolists that frothy speakers at towns' meetings describe them as being in the hearing of the unreflecting populace.

Naturally, townspeople do not like the prospect of dearer gas; but how much more the additional 2d. or 3d. per 1000 cubic feet seems to hurt them than a corresponding reduction gratifies them! Let the price of gas go up ever so little, and the "great heart of the people" is moved to its depths. Town halls are thronged by excited crowds, pouring upon the devoted heads of gas directors the indignation which is occasionally placed at the disposal of orators who loudly denounce "atrocities" of another kind. There are places in this England of ours where, during the last few months, have been heard such denunciations of those worthy and respectable citizens who happen to be entrusted with the management of the local gas undertaking, as recall the historical Bulgarian agitation; and all about an extra penny or two upon the price of a thousand cubic feet of gas! Why, it may be asked, in the name of all that is reasonable, should gas be exempt from the common character of marketable commodities, in being dearer or cheaper from time to time as the conditions of trade alter? Surely, if it does not pay to sell gas at a certain price, the vendors are at liberty to ask more, just as, when times are good with them, they are free to take something off.

The fact of the matter is that the exceptional position accorded to the gas industry by the Legislature is only dimly understood, if it is understood at all, by the kind of people who attend public meetings, and pose as representatives of the community to which they belong. They are not, as a rule, the sort of spokesmen who would be selected to proceed as a deputation, and assist a Parliamentary Committee to settle the terms upon which gas or anything else should be supplied in their districts. Such persons would be surprised to learn that statutory protection is given to Gas Companies, not in order that the directors should be able to charge whatever price for gas they might think necessary for the production of "bloated "dividends," but in order that gas should be sold in the district at the lowest possible price. This is, practically, the end and aim of all Gas Acts; and if these are not found to work in the proper sense, it is open to anybody to suggest some better principle of regulation. It is easy to show, however, that the so-called monopoly does, as a matter of fact, render gas cheap, and also keeps it cheaper during times of temporary pressure upon the

suppliers, than would be the case if statutory protection were lacking. To begin with. Although the public do not go into raptures over reductions in price, they do far better—they use gas more freely the cheaper it is; and so they encourage the producers to sell it at as low a figure as possible. When the selling price of gas has been thus brought low, the producers know full well how detrimental to their own interest would be any advance in their charges; and so they put off the evil day as long as they dare, even after the markets in which they buy their materials and labour have turned against them. They keep hoping against hope that coal will drop, that coke will go off, that tar will improve—anyhow, that the pinch will only last a short time. And so, when the adverse conditions continue longer than can be tided over without loss, the reserves which represent the savings of better times are drawn upon until the business stands, as it were, in its bare bones. Now, this latter process can only be carried on by virtue of the statutory protection which the gas undertakings of this country enjoy. The power of calling for an improved revenue is the best guarantee that the call will only be made as a last resource. If British gas companies had no cash reserves, and were liable to be harassed by marauders at any moment, they would not dare to deprive themselves of reserve cash for the sake of staving off an increase in price; they would keep the money-bags intact, whatever else might happen. And there are not lacking Municipalities in England, who, because they have to carry on gas undertakings without the power of temporary compensation which a cash reserve confers upon gas manufacturers, are compelled to put up the price of their gas upon occasion much more promptly than a strong Gas Company would find necessary.

Such considerations as the foregoing should prove more consolatory to ratepayers and consumers smarting under a sense of wrong merely because their local Gas Company has advanced the price of gas by a few pence per 1000 cubic feet, than the usual vapourings about burning oil or starting electric lighting. As to the latter especially, it is ludicrous to remark how an advance of a penny or two upon the price of gas is popularly supposed to bring electric incandescent lamps "within the sphere of practical "politics," whereas a rise of as many shillings would be powerless in this regard. Yet, although we may be able to prove to demonstration that popular agitations against increased gas bills are irrational, they are inevitable; and those who are affected by this virtuous indignation deserve sympathy and pity rather than censure or scorn. Gas is so necessary to the comfort of town populations, and enters so largely into the calculations of traders and shopkeepers even more troubled to make both ends meet than Gas Companies, that popular protests against its dearness are not to be dismissed impatiently as the ill-conditioned grumblings of people who want something at less than its value. Cheap gas is such a boon, that the wise and humane gas-works administrator will go a great way to avoid the necessity of appearing to withhold it, and will use his utmost efforts to lower his selling price, and keep it low.

The "Poser" of Water-Gas Manufacture.

THERE is a rather amusing reference to the examinations in Gas Manufacture of the City and Guilds of London Institute, in a recent issue of *Progressive Age*—the American "organ of water gas." Our contemporary freely admits the utility of these examinations, but comments upon the absence of questions covering anything relative to water gas. This deplorable omission is explained by a pitying reference to the notorious fact that "the Englishman has "not yet awakened to the fact that water gas is a living "issue in Europe." Seeing that "the Englishman" thus referred to can be none other than the Examiner in Gas Manufacture—Mr. Charles Hunt, of Birmingham—it is more than we should like to say of him that he is not fully awake to anything and everything in and about the gas industry in this country. Our contemporary goes on to supply the omission, and suggests two or three very ordinary questions as being suitable for sounding the capacity of young American students in gas manufacture. We have no fault to find with this rather feeble attempt to impart a little local colour to the idea of the examination; but it is too much to pretend that English engineers need awakening upon the subject of water gas. As an illustration of the purely water-gas questions which Mr. Hunt may or may not think fit to put into his future papers, we suggest the following, and claim that it is very much more to the point than anything proposed by *Progressive Age*. It is this: "Given a fluid hydrocarbon "costing anything from 3½d. to 5d. per gallon, how is "carburetted water gas to be made to the same advantage "here as in the United States, where the same class of "carburetting material can be had for one-third or one-"sixth the price?" This is the question of questions for English dabblers in water gas at the present time. It is easy for journalists on the other side to affect to look down upon the Englishman's technical attainments; but let the critic come over here and take off his coat to a cask of Solar Distillate, and if he succeeds in wrestling with this material at its market price, he may leave criticism to somebody else for the remainder of his days.

A Lesson in Industrial Economics.

AT last the delusion of the leaders of the Coal Miners' Union, which led them first to try the experiment of a "stop week," and then of a "stop day" in every week, has been exploded by the contact of facts; and at the present time the coal miners are working in the same way as other labourers—that is, they are making as full time as they can—the idea that prices could be kept up by restricting the output being altogether abandoned. As our contemporary the *Engineer* remarks, in commenting upon this subject, the experiment has been worth doing. For years the men's leaders have been preaching a policy of restriction of the output; and now it has been tried to the hearts' content of everybody concerned, with the result that things are left exactly as they were. The public have suffered where they were in the power of the middleman. But nobody has really benefited in the long run; and so a beautiful piece of "new" industrial economics has been weighed and found wanting. It will be well if, as our contemporary opines, "the lesson "taught in the coal-fields will not be lost in other depart-"ments of British industry." The worst of it is that during the last few years whole groups of workers—miners, gas stokers, coal porters, dockers—have been so infatuated by the magnetism of mere talk, that they have resigned their livelihood to the keeping of men destitute of all recommendation to their confidence beyond the "gift of "the gab." It has been a boast of these men that they would not consent to be guided by the results of other people's experience, even though these were unionists like themselves, albeit of an older school. They were founding the "New Unionism," and everything about it must be new also. So their dupes have paid dearly for verifying a few old truisms by the fearfully expensive method of experience; and there is no guarantee that a score of years hence, or even less, a new order of agitators may not arise who will ostentatiously turn their backs upon the lessons of our time, and muddle on in the same old vicious circle of strikes, lock-outs, and all the rest of it, just as the Burnses and the Manns have done of late, and would do again to-morrow if trade were not so "sick" as it actually is. For the true demagogue never learns anything, or he would cease to be a demagogue. One specimen of the order follows another, but there is no essential difference between them; and when they cease troubling for a season, it is not because of the increase of wisdom, but only on account of the shortness of the funds.

An Epoch-Making Discovery.

IT is necessary to go back to the dawn of the Bessemer steel process, and the evolution of the Siemens-Martin invention, to find anything so artistically complete of its kind as the new alkali process of Mr. Ludwig Mond, which is described in another part of the present issue of the JOURNAL. For some time past—in fact, ever since the ammonia-soda process of alkali manufacture has been a working, commercial success—the older Leblanc process has kept its position solely by virtue of its valuable residual, chloride of lime, which was not obtainable by the new and more economical method of making soda-ash. Now, however, the last support has been cut away from the Leblanc process by the brilliant series of manufacturing operations perfected by Mr. Mond, which begins with the carbonization of coal in coke-ovens, and ends with the products enumerated in the well-written article already referred to. Apart from its general interest as an illustration of the triumphs of skill and patience over a peculiarly intractable

form of matter, it is in its dealing with coal that the new Mond process comes near to our readers. This accomplished chemist appears to handle elements and compounds as a juggler plays with rings and cards—making them shift their forms and embodiments at will. Nay, the written record of a game of chess hardly reads more like the effect of pure will-power working through complex combinations towards a simple end, than does the paragraph of *The Times* article which, after narrating how the new process is engrafted upon the ammonia-soda process, concludes by stating that "thus the chlorine of the "original brine is combined with the lime of the original "chalk; the soda of the brine is combined with the car-"bonic acid of the chalk; the ammonia and the magnesium "oxide employed in the process have been given back "in their original forms; and nothing has disappeared "except the coal, which has furnished the heat required to "effect the transformation"—and of the coal nothing is wasted. It is as good as an exercise in mental gymnastics to try and appreciate the plotting and planning that must have gone to the inception and successful working out of this astonishing feat of chemical industry.

"When the Blind Leadeth the Blind"——

In some observations credited to Mr. B. Pickard, M.P., President of the Miners' Federation, speaking at Barnsley last Saturday, may be discovered one of the reasons why there are so many misunderstandings between employers and employed in the national industry of coal mining. Mr. Pickard appears to have seen a cause of offence in the report of the Leeds Corporation Gas Committee on their coal contracts, already referred to in the Journal, which he characterized as "exulting in having accepted tenders "for gas coals at lower rates;" and he remarked thereupon that, "although coal-owners might complain, with "regard to certain classes of coal, that they could not get "a fair price, yet they wilfully and persistently lowered "the value of coal to gas companies and others who are "more able to pay fair prices." He also contended that there was no excuse whatever for reducing the price of gas coal, "for gas companies throughout the United "Kingdom were paying dividends as high as the law will "allow, and bonuses, evading the letter and spirit of the "law, where such payments are possible." After this, it was hardly necessary for the speaker to declare that Trade Unionists connected with miners hold that there is no need to reduce the price of railway and gas coal; and that, if this is done, the miners will not submit to any reduction brought about by such evil competition. There could not be a better specimen of the misleading perversion of truth by which a certain order of Trade Union leaders seek to impose upon their confiding followers. How are employers and employed to make common cause, while the latter pay men to tell them such wilful lies as are contained in this report of Mr. Pickard's Barnsley speech, and remain content to take their information respecting commercial transactions and methods from such sources? It is hardly necessary to expose, even for the benefit of the working-class readers of the Journal, the misstatements of this interested orator, who was possibly driven by the circumstances mentioned in another paragraph to abuse the mine-owners and their best customers, by way of diverting attention from the disastrous failure of the policy with which the speaker has been identified. If those popular lessons upon Political Economy and the principles of the existing industrial system of this country, which we should so dearly like to see initiated by somebody who knows the rights of the subject, and is not afraid of telling the truth to a labouring-class audience, should ever be undertaken, it is clear that the first course of such teaching must be an exposition of the doctrine that "the worth of any-"thing is just as much as it will bring." Not one of our modern "labour representatives," in Parliament or out of it, has the remotest conception of the reasons which actuate buyers and sellers of marketable commodities. For anybody to talk about a seller "wilfully and persis-"tently lowering the value" of his commodity, is to utter the most immeasurable nonsense; and that men who know how to buy a loaf of bread or a pint of beer should listen to it without immediately detecting its quality, is a melancholy evidence of the power of the spirit of Trade Unionism to blunt the intelligence of its dupes.

WATER AND SANITARY AFFAIRS.

Hydro-geological evidence respecting the Thames and Lea watersheds occupied the attention of the Royal Commissioners on Metropolitan Water Supply during the three days of their sitting last week. Several of the witnesses asserted the practicability of constructing a series of impounding or storeage reservoirs in the Upper Thames Valley, as proposed by Mr. H. J. Marten and Mr. Henry Rofe, engineers who had previously given evidence on behalf of the Thames Conservancy Board. The approval on this point was a little qualified in some cases; but not to any material extent. Mr. Topley was in doubt as to the water-tight character of some of the sites; and therefore proposed others. The Windrush site he considered absolutely water-tight; and other witnesses spoke to the same effect. Reservoirs that would slowly leak were suggested by Mr. Topley as calculated to help the underground storeage—a plan which had been adopted on a small scale at Scarborough. Dr. Henry Woodward considered the proposed reservoir on the Windrush as most important; and he approved generally of the whole of the sites. Mr. Horace Woodward was confident that each of the sites was either water-tight or could be made so. Mr. Robert Etheridge estimated that 100 million gallons of water per day flowed away from the valleys of the Thames tributaries, which could be utilized for London if storeage reservoirs were formed. He spoke of "seven admirable sites" which he had visited, where reservoirs could be excavated entirely in the Oxford clay. Professor Boyd-Dawkins considered that the reservoirs proposed by the Conservancy engineers were the best that could be devised under the difficult circumstances of the Upper Thames; but some of them were good in themselves, more especially that on the Windrush. Where leakage was to be feared, it might be prevented by means of wing trenches. Evidence adverse to the formation of these reservoirs was given by two witnesses whose views were well known. These were Professor A. H. Green and Mr. W. Whitaker, who presented a joint report to the County Council last year, on the geology of the Thames basin, and on the possibility of constructing therein reservoirs for the storeage of water. Professor Green held that it was "hopeless" to attempt the construction of storeage reservoirs in the limestone area, owing to the large fissures in the rocks; while in the clay districts the valleys were broad and open, so that to impound any quantity of water there must be great breadth and little depth, producing what the witness called "overgrown puddles." Mr. Whitaker "very much doubted" whether works could be safely constructed in the superficial deposits. It will be observed that this opposing evidence is based on general geological considerations, and does not appear to be the result of an actual examination of the sites proposed.

Another and still more important branch of the inquiry is that which relates to the amount of underground water obtainable for the supply of London, especially from the chalk. On this point Mr. Whitaker's evidence does not seem particularly clear. Being personally acquainted with some of the largest wells by which water is obtained from the chalk, he considers that the Companies might draw "large "additional supplies" from that source. The Kent Company, he believes, could increase their supply to "a very "large extent indeed," by extending their works to the east. He is of opinion that a series of wells might be put down with success at or near any part where a tributary of the Thames passes through chalk or the tertiary formations. These statements would seem decidedly favourable to the prospect of a supply from the chalk; but we find Mr. Whitaker going on to say that whereas, if he were granted the requisite powers, he would undertake to supply London for many years with water from the chalk wells, he also felt assured that the process would dry up most of the tributary streams. It is here that we come to the critical point—whether there is or is not water enough in the chalk to maintain a proper supply for the Metropolis, and at the same time to feed the rivers and streams. In reality, the question is not quite so critical as this; it not being clear as yet that all the water to be supplied to London and its environs must needs come from the chalk. If the river supply is kept up to its present standard of purity, the increased volume taken from the chalk need only be supplemental; and this is what is generally understood. The storeage

reservoirs also come in to help. Professor Boyd-Dawkins speaks of an enormous percolation of water into the chalk, creating a store from which the surface streams merely take the overflow, the rest gravitating downwards, and in course of time finding its outlet "in the Thames "estuary and into the sea." That some such process is going on has been frequently asserted; and there is much to confirm the idea in the statement made by Professor Boyd-Dawkins, that the head of water to the east of Erith is so great that it is only with difficulty the foundations of the houses can be made. So also the chalk quarries in that district cannot be worked lower than a foot or two above Ordnance datum, because of the head of water. It would seem that, in this matter of the water supply, London may lay to heart the motto: "Waste not, want "not." As the result of inquiries carried on by him in the area round London during the last fourteen years, Professor Boyd-Dawkins is led to the conclusion that there is "a very large body of water" available from wells for the use of the Metropolis, "without injury to the surface." Even those who take an opposite view to this witness are constrained to own that a very large additional supply of water is to be obtained from the chalk; but it is objected that this can only be accomplished by starving the streams. It is this objection against which the battle has to be fought. The sinking of the water-level under London, so far as it really occurs, is not conclusive in proof of a general reduction in the supply or its source. The testimony of Mr. Colin Docwra, whose firm has been sinking wells in the London basin for more than half a century, is that the "standing level of the water in the Upper Lea "Valley is in some wells higher than it was from seven to "twelve years ago." Mr. C. E. De Rance, whose study of the question of underground water has been extremely extensive, is strongly of opinion that a large supply is obtainable from the chalk. A remark made by this witness suggests the idea that where a stream apparently shrinks in its volume, the circumstance may be due to other causes than the pumping of water from the underlying strata. May not agricultural drainage, and even the extension of house-building, have something to do with this? Some striking observations were made by the President of the Commission in dealing with the statements of Sir John Evans. It would seem that Lord Balfour attaches considerable weight to the evidence which shows that the supply from the wells will be ample for the wants of the New River and East London Companies until 1931, with something yet to spare.

Mr. Arthur F. Goodson, who has been connected with the Drighlington Gas Company as Secretary and Manager for many years, has been appointed to the managership of the Heckmondwike Gas Company.

Mr. Lass's Analysis of the Metropolitan Water Companies' Accounts.—An announcement which appears in the advertisement pages of the JOURNAL informs our readers of the issue of the analysis of the accounts of the Metropolitan Water Companies prepared annually by Mr. Alfred Lass, F.C.A. This is the twelfth year of publication of this useful collection of statistics. Those now presented relate to the twelve months ending Dec. 31, 1891, or March 31, 1892, according as the Companies' accounts are made up to one or other of those dates; and their arrangement is the same as in previous years. The figures do not call for detailed notice, as they show at a glance the extent of the capital and the magnitude of the operations of the eight important undertakings to which they relate. They are of special value now, in view of the attention which is being given to the question of the Metropolitan Water Supply.

A Souvenir of the Murdoch Memorial Gathering at Stirling.—We have received from Messrs. Maclure, Macdonald, and Co., of Glasgow and London, a large photograph of the party of ladies and gentlemen who assembled at the Wallace Monument at Stirling, on the occasion of the meeting of the North British Association of Gas Managers in that town in July last, to witness the ceremony of unveiling the bust of William Murdoch, which, it may be remembered, was performed by Lord Kelvin. The visitors were skilfully grouped with the Monument as a background; and an effective picture has been produced. Of its execution it is unnecessary to speak, in view of the position of the firm to whom it was entrusted. It may be mentioned that Messrs. Maclure and Co. are prepared to supply copies of the photograph framed in oak. As a souvenir of a ceremony which marked an important event in the world's progress, and, it should be added, presented in tangible shape the results so far achieved of the labours of Mr. James M'Gilchrist and his colleagues on the Murdoch Memorial Committee of the Association, the photograph should be interesting to many more than those who by its means are permanently associated with the celebration of the Centenary of Gas Lighting.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 741.)

A COMPLETE change in the aspect of things in the Stock Exchange was effected in the past week; and the warning note we struck in our last issue with regard to the true character of the rise in prices has been very quickly justified. In plain English, the advance was too good to be true; and, although these movements are usually engineered in a very clever manner, this time it was run up just a little too briskly. So the usual snapping up of profits nipped it—if not in the bud, certainly long before it was fairly blown; and prices have fallen back again. Too much stimulant is bad for men and for markets. The Money Market, too, has at last been galvanized by an outside demand for gold; and the Bank rate was raised on Thursday to 3 per cent. The 2 per cent. rate had lasted for six months all but one week—the longest innings scored for thirteen years—though it was nearly equalled in 1885 with a record of only one week less. The Gas Market showed an increase in activity; and, although there has been some little fluctuation in prices, it may be set down as firm. In Gaslights the "A" opened rather easy; and, there being no demand for a day or two afterwards, the quotation was dropped 1½. A recovery, however, was almost immediate; and the last prices marked were the best of the week. The demand for first-class investment securities has fallen off recently; but, notwithstanding this, the secured issues—debenture, preference, and limited—were all in good request, and active at prices which showed no diminution in value. There were not many transactions in South Metropolitans. But what there were commanded capital figures; and the "A," though not dealt in, rose 5. Commercials were quiet and unchanged; two or three dealings in the debenture stock being all the record. Little was done in Suburbans and Provincials. But all stood firm; and Alliance and Dublin rose ½. The Continentals were very brisk; and prices were steady on the whole, though European fully paid lost the rise of ½ which they effected the week before. None of the rest present any feature, except the South Americans, among which Buenos Ayres debentures are nearly up to par again; and San Paulo have made another advance of ½. In Water, the great activity in East London was the chief feature, coupled with general firmness, and a slight advance in Grand Junction and Kent.

The operations were: Dealings in Gas were not extensive on the opening day; but prices were pretty good, except for Gaslight "A;" and the advances named in Buenos Ayres and San Paulo took place. In Water, Grand Junction rose 1. On Tuesday, Europeans were more dealt in than anything else; and the fully-paid shares fell ½. Wednesday was a very quiet day; and all quotations remained without variation. On Thursday, there was some revival of activity; and although Gaslight "A" was reduced 1½, yet prices were better both for it and for all. Alliance and Dublin improved ½; and Grand Junction Water did the like. The favourable tendency continued on Friday; and Gaslight "A" recovered 1. Kent Water also rose to a similar extent. Saturday was very active for a Saturday; and the good prices showed no falling off. South Metropolitan "A," though not dealt in, rose 5.

ELECTRIC LIGHTING MEMORANDA.

The City of London Electric Lighting Company and the Commission of Sewers—Canvassing by Local Authorities—Railway Carriage Lighting—The Cost of Lighting by Primary Batteries.

THE presentation of the first bill for the electric lighting of some thoroughfares in the City of London was the occasion of a lively debate at a recent meeting of the Commission of Sewers. The amount was only about £1200, and was for the period up to June 30 last; and was recommended for payment by the Streets Committee "without prejudice to the contracts and Provisional Orders." On the face of it, the request was reasonable, as the Commission owe the City of London Electric Lighting Company very much more than the amount asked for; and there is no question of rate of charge or anything that might be set off against the account. It happens, however, that the Company have put themselves in the wrong with the citizens by their delay in carrying out their engagements; and when, after all, they did proceed with the laying of their mains, they took advantage of their way-leave to put down additional tubes for telephone wires, which they propose to let out at a rental. Their action was defended on the score that the revenue derived from the Telephone Company would help indirectly to cheapen the electric light. This excuse is hardly accepted, however, by the Commissioners, who see in the circumstances attending the origin of the Company good reason for regarding their proceedings with extreme caution. Therefore it is not surprising that, when asked to pay the Company's lighting bill, these things should be talked over in the Commission with some acerbity. In the end, the Company

got their money, although not before some sharp things were said about their having "stolen a march" upon the City in the matter of the telephone tubes. This is no new experience of the Corporation. There are many members of the Court of Common Council and its Executive Committees who are as upright and public-spirited as any men who might be found in other local governing bodies; but, somehow, the poor old City is always being "done" by those who serve it.

Our contemporary the *Electrician* waxes sarcastic over the recently published statement that the Wigan Town Council received less than ten favourable replies to their circular canvassing for support in the event of their undertaking to set up a central electric lighting station; remarking that if the circular was "anything like as pressing an invitation to take the electric current as is usual where a municipality owns the gas-works, the meagre response probably did not surprise the authorities concerned." And reference is made to a similar invitation which is stated to have opened somewhat as follows: "Assuming that electricity will cost you x times the price of gas, are you prepared to take a supply in the event of the Gas Committee laying down an electric lighting plant?" Naturally, the correct answer to this equation is a negative. The point is a very fair one; but the trouble really originates in the speculative nature of the proposed venture. A local authority contemplating the formation of an electric lighting department, to be maintained out of the rates, has the option of going to work on speculation—laying down plant as advised, and trusting to the supply creating the demand—or of trying to learn in advance, by the agency of canvassing, what is the minimum demand upon which the new business will have to rely for support. A public body, adopting the latter expedient, cannot indulge in those airy promises by which an irresponsible trader might endeavour to attract patronage. It is expected to tell the truth; and if the truth is of a kind which speculative electricians in similar circumstances would be careful to suppress, it is difficult to see that the teller is blameworthy. Carried out to its logical termination, the criticism of our contemporary means that local authorities should not touch electric lighting till freer speculators, who are in a position to make larger use of the license of advertisement, have got a business connection together.

The latest attempt to overcome the difficulty, which is mainly of a pecuniary cast, of applying electricity to the lighting of railway carriages, is after the penny-in-the-slot method. It is reported that to the Metropolitan District Railway Company belongs the credit, such as it is, of being the first to adopt a system of electric lighting for their carriages which supplies a reading light near the user's hand, and, without costing the Company anything, gives the travelling public just what is wanted. This *desideratum* is in the form of a little arrangement invented by Mr. Pourtel, which is to be attached to the back of the carriage compartment, and is rated to give a light of 3-candle power for half an hour, at the small charge of one penny. So satisfied are the Railway Company with the experimental trials they have been making of the Pourtel invention during the past two years, that they have decided to extend the experiment to the number of 10,000 lamps. This is one way of relieving themselves of the trouble and expense of properly lighting their carriages *pro bono publico;* but we doubt if habitual users of the line will regard it as a satisfactory expedient. To have to pay a penny for the pleasure of reading a penny, or possibly a halfpenny, newspaper for half an hour, would amount to a serious tax upon the regular traveller.

Some figures relating to that much-debated subject, the cost of electric lighting by primary batteries, are published with reference to the working of an installation of Weymersch batteries at a country house near Horsham. The plant comprises a primary battery arranged to charge an accumulator of 26 E.P.S. cells, from which 30 lamps of 8-candle power are fed. Reckoning the cost of working the battery alone, without taking into account the loss by the accumulators (for which, however, the user has to pay), it comes out at £4 2s. 3d. for the six months, for materials alone, not taking any account of credits for partially-used zinc scrap, which might perhaps pay for labour and carriage. The battery will yield from 750 to 800 watt-hours per gallon of solution effectively when charging an accumulator; and as 25 gallons were used during the period in question, yielding about 19,000 watt-hours, it follows that the cost of 8-candle power lamps ran, for materials alone, at something between 1¼d. and 1½d. per hour. The working of the battery is stated to have given complete satisfaction. This is all very clear—so far as it goes; but as nothing is said about interest on prime cost, depreciation, or renewals, it would not be out of the way to estimate these extra charges at about ¼d. per lamp per hour, which would bring the total cost of the 8-candle power lamps up to about 2d. per hour—a sufficiently costly average, even if the nominal candle power did not greatly vary from the actual. If, however, as is most likely after six months' use, the majority of the lamps yet remaining in service have settled down to a comfortable 5 or 6 candle power effulgency, it does not appear like a perversion of the truth to describe this particular specimen of country-house lighting as the most expensive for its quality in the kingdom. Still, it may be freely conceded that a total lighting bill of £10 or £12 a year is nothing very dreadful for a gentleman who has a fancy for the style of lighting, and does not want the trouble of a dynamo and motor.

CRIPPS ON THE FLOW OF GAS IN PIPES.*

In this set of diagrams and the accompanying letterpress explanations and observations respecting their use, Mr. F. S. Cripps has produced a monumental work which should entitle him to be remembered as one of the benefactors of the hard-working practical gas engineer. Calculations of the flow of gas through pipes, of the loss of pressure by gas in course of delivery, of the dimensions of pipes necessary for supplying gas at a given pressure and in a certain quantity, have hitherto been among those things which the practical gas manager has sometimes talked about, but very seldom touched. The possibility of doing without the well-known Barlow's Tables, and of arriving at the result of the most careful working of Dr. Pole's formula by simple inspection, must appear to gas engineers a facility almost too precious to be true; yet this is exactly what Mr. Cripps offers, as the fruit of some exceedingly clever and laborious work. How difficult was the task which Mr. Cripps set himself in the preparation of these diagrams may be judged from the fact with which he had to start—that he had five elements or factors to reckon with, and the problem was to show, by mere inspection of any four of these, an unknown fifth. Bearing this in mind, it can be well imagined that, as the author says in his prefatory remarks, it took "considerable thought and study" to settle the mode of constructing diagrams suited to the object in view. With regard to the degree of success attained by Mr. Cripps, we are able to declare at the outset that it is ample for the purpose; and we only hope that the suggestion which set the author at work upon this difficult subject—that "a diagram giving at a glance the flow of gas through pipes of various sizes and lengths, under different pressures and other varying conditions, would be of great service to gas engineers," will be justified by the welcome Mr. Cripps's production will receive from the technical public.

The diagrams are four in number, and range between them through all dimensions of pipes from ¼-inch to 60-inch bore, and from 10 yards to 35,000 yards of length; through all gas pressures of from 1 to 100 tenths; through specific gravities of from 0·4 to 0·7; and through discharges of from zero to a million cubic feet of gas per hour. Thus it is no exaggerated claim to say that every problem of the flow of gas that is likely to come within the purview of the gas engineer falls within the scope of these diagrams. They are, moreover, straight-line diagrams; so that intermediate results can be plotted from the same—a great point in the graphical method of solving problems. It is unnecessary, even if it were possible, to describe here the method of using the diagrams. Clear directions are given to this effect; and the whole thing is so simple that any one of the five results deducible from the diagrams can be picked out at once by a neophyte, while with practice the sheets become as easy of reference as an almanac or a ready-reckoner.

An obvious criticism upon all computations relating to the flow of gas through pipes refers to the disturbing effects of differences of grade, angles, bends, branches, &c., which are unavoidable in practice. Mr. Cripps has not overlooked these considerations, which he admits to be complicating; and he wisely seeks to reduce the complexity, and the consequent uncertainty, to the nearest approximations. In this matter of pipe discharges, it is impossible to be quite accurate, owing to the multiplicity of unmanageable and accidental influences which affect a working as contrasted with a theoretically perfect pipe-line. Knowing this, Mr. Cripps has sought to put in the engineer's hand a simple and practical rule which shall give results agreeing as closely as possible with those obtained by experiment. He has not strained after unattainable precision. As an illustration of this we could refer to the author's treatment of the effect of branch pipes on a trunk line, which is refreshingly robust in its adherence to round numbers. Very prudently, as we think, Mr. Cripps prints some remarks of Mr. George Livesey upon the proper usage of rules and tables in connection with gas distribution. In old town districts, where mains of all sizes have been laid as wanted in every direction, and where the branches are so frequent, and the course of flow so arbitrary, that it is impossible to say how much gas a particular length of pipe is or ought to be giving, the distributing engineer must be guided solely by the pressures. "When the supply in any district becomes deficient, and we [South Metropolitan Gas Company] have to put on an excessive pressure, we simply trace the pressures along the line of main, find where the falling off takes place, and then relay with larger mains, or increase the supply by another route." There are plenty of purposes, however, as Mr. Livesey readily concedes, for which what he calls Mr. Cripps's "most simple and perfect tables, will be exeedingly useful." No engineer can require convincing argument upon this head, since the advantage (or necessity) of knowing the delivering capacity of a trunk main is only minimized by such as have shrunk from the calculation required to ascertain it according to the laborious method now happily superseded by Mr. Cripps.

* "The Flow of Gases and Proportioning Gas-Mains." A Set of Four Diagrams, with Explanatory Pamphlet, for solving at a glance the Various Problems involved in Proportioning Gas Mains and Services, to suit the Varying Conditions of Diameter, Length, Pressure, Specific Gravity, and Discharge; with Notes as to Allowances to be made for Bends, Branch Mains, and other Disturbing Influences. By F. Southwell Cripps, Assoc.M.Inst.C.E. London: Walter King; 1892.

THE DISESTABLISHMENT OF THE CONTRACTOR.

When, in the first number of the Journal for the current year, we published an essay upon the "Decay of the Contract System"—treating this phenomenon as a sign of the times, and showing some of the reasons that might be fairly considered as conducive to it—we were not to know that, before the year had closed, the movement then recognized would receive such support and impetus as it may be expected to derive from last week's decision of the London County Council to undertake their own building work. It is often remarked of popular tendencies which now and again take definite form as "new departures" in governmental and administrative matters, that they can be "felt in the air" by observers who are on the spot, and are not too preoccupied with pushing their own notions to the front, or in seeking support for their own prejudices, to perceive the direction in which the world is moving. We do not lay claim to any superior powers of perception in referring to our anticipation of the line of action so lately taken by the Metropolitan governing body, which proclaims its Progressive character not merely by words but by its acts. It is simply impossible to close one's eyes to the evidences that accumulate from all sides to support the conclusion that the age of the General Contractor is passing away. The London County Council's decision to undertake on its own behalf the building of certain artisans' dwellings, rendered obligatory on this body by the clearances necessitated by the Blackwall Tunnel works, would be a small thing if it stood alone; and we should scarcely be warranted in discussing it at any length, even with regard to its aspect as an important sanitary improvement. As a striking testimony to the strength of a new industrial sentiment which must henceforth be reckoned with by all who are interested in the subject of public works, however, this step on the part of the London County Council deserves the amplest notice and the fullest consideration.

Of course, the numerous well-meaning persons whose idea of the function of administrative authorities, whether national or local, is that of mere "marking time," are raising a good deal of clamour over this London County Council experiment; crying "Socialism" and other terrifying things in the ears of the ratepayers whose money is to be spent upon it. It is too late in the day to try and discredit an administrative experiment by calling it names. In this, as in other work-a-day affairs, the only question that arrests the attention of the practical man is: How will it answer? And it must be conceded at the outset that the General Contractor has not done much of late to justify his existence as a factor in the problem of obtaining the best return for the outlay of money upon public works. The experience of the London School Board has not been happy in this respect; it having lately cost this body tens of thousands of pounds only to find out how sadly much of the money spent upon their school buildings has been wasted. Nor is the retrospect brighter if one turns to Liverpool, Manchester, or many of the other large towns which have in recent years spent large sums upon water supply, harbour, and drainage works. Almost everywhere evidence can be found of the breakdown of the system of accepting the lowest tender, which is the necessary concomitant of the contract method of constructing public works. In general reflections like this, it is impossible to refer to possible exceptions; but the only (at any rate the brightest) example of the utility of the General Contractor that occurs to mind for the moment is that of the late Mr. Thomas Walker, of Severn Tunnel fame, whose untimely death was one, and not the least, of the causes of the difficulties that have crowded so thickly upon the Manchester Ship Canal Company.

Indeed, the contract system for public works has become top-heavy; the arrangements for overlooking the execution of works, while failing, more often than not, in securing the due execution of the engineer's designs, being intolerably costly and cumbersome. With the bright exception of those contractors who have worked for honour as well as for profit, the fundamental temptation of the contract system has been too much for those who have become identified with it. Nor is this to be wondered at when it is remembered that all the industrial world is at the command of the contractor who is committed to the enterprise of carrying out a low-priced job with the cheapest materials he can find. It is not necessary that a contractor should be knowingly fraudulent in the discharge of his obligations. To him, the living product of a system, carrying out a job according to plan and specification means merely satisfying certain definite tests. He has to work up to a particular gauge; and so long as he does it, he is not legally blameworthy. If, in order to pass the tests, and get out on the right side, the contractor has to use a make of iron which is not precisely what the engineer contemplated, or a brand of cement which will not look so strong in a few years' time as it does at sight, how is he to be prevented? In placing their contract, the contractors' customers have to take their risk. They surround themselves with checks and safeguards which profit nobody, and add seriously to the cost of the work; and all the time of execution their agents are divided between their fears for the consequences of "breaking" the contractor, if they are too hard upon him, and of passing work and materials which lie upon the border-line of acceptability.

It is not to be imagined, however, that the disestablishment of the contractor will be the signal for the disappearance of all troubles in connection with the execution of public works. Whatever may be said against him, the contractor has stood for the brains by which alone labour can be advantageously directed towards the attainment of a given object, and materials used most expeditiously and with the least waste. It requires one kind of ability to design works, and quite a different kind to carry them out. If our modern local authorities, railway, gas, and water companies, are to do their own work in the future, whenever possible, it must come to this: They will have to establish a distinct executive branch for the purpose. There must be no misconception upon this head, or confusion will follow, and the new system be discredited. However simple the organization—and in most cases it will be found extremely so—the old distinction between the planning and consultative and the contractor's staffs must not be lost sight of. Where this rule is observed, the best guarantee for the successful execution of works of construction will be preserved.

It has been remarked that, in resolving to carry out their own constructional works, local authorities and public companies will be endeavouring to secure the advantages of the contract system without paying for the contractor. This is only true of the sense in which the contractor represents skill, which must, of course, be paid for in whatever shape it may be employed. Usually, however, the contractor charges for a good deal more than his skill and experience. It is a saying of contractors that "it is a poor job that does not pay for the plant"—which disposes of one objection, commonly urged against doing away with the contractor, that in this case the customer must provide a mass of expensive plant for which, unlike a contractor, he has no regular use. This objection appears much more formidable than it really is; for plant which is perishable must be charged to the job in any case, and the rest can always be hired, or kept from one job to another. Besides the use and cost of his plant, the contractor charges for his trade risk and for the capital which he needs; and he naturally tries to make sound customers recoup him for losses in connection with weak ones. Moreover, all the sub-contracts in a job pay the general contractor something for nothing, and so go to swell the cost of the whole. Notwithstanding all that can be urged against the contract system, it will last for a long time yet, as a convenient means of negotiating unknown risks. All that has hitherto been said in favour of dispensing with the middleman-contractor only applies to such works as can fairly be described as ordinary, and not requiring for their successful and economical execution any exceptional talent, enterprise, or courage in facing and taking risks. Plenty of the latter class of jobs will remain to give employment to the General Contractors of the future, even if all the most settled and routine descriptions of public works are done without their assistance; but the requirements of public and statutory bodies are mainly of the latter kind.

There is another aspect of this new departure of the London County Council to which we must devote a few words before quitting the subject. Although it is advocated and adopted for economical reasons, the party which stands committed to make it a success, as compared with the contract system, is also the party of Social Democracy, New Trades Unionism, and the levelling-down theory of salaries and wages. These matters have so far been kept out of the Council's discussion of the subject; but nobody is likely to forget that they may possibly have a bearing upon the carrying out of their resolution. We are glad that this is so, and that our raw theorists in industrial economics will have an opportunity of seeing how some of their ripest notions work in practice, upon a scale large enough to make a reliable object-lesson, and yet not so considerable as to give cause for anxiety as to the result. For of course Eight-Hourism and every other industrial fancy that has been pressed upon employers by Mr. John Burns and his followers will be given free scope in this notable experiment; and, above all, nobody will be paid too well for looking after the others. It is a pet phrase with the New Unionists that "Labour is the source of all wealth." But many an unfortunate employer of labour has had occasion ere now to recognize that the payment of wages is not an infallible means of becoming rich. This is simply because the employment of labour profitably is like every other trade—its profits depend upon circumstances, and especially upon the skill with which it is directed. It may be true that the ultimate source of much, if not of all wealth, would be found in labour, if it could be traced out; but it is emphatically not true that all labour always and invariably produces wealth. The late Walter Bagehot pointed out that in the present day unassisted labour—the labour which is not reinforced by machinery or by skill—produces very little return for its cost; whereas assisted labour is more productive than it ever was. And the same writer also showed that everything that assists labour is to be classified as capital. Even the trained skill of a mechanic is as much capital as the cash which the employer expends in machinery for rendering the workman's labour as productive as is possible for its kind. Unless we are greatly mistaken, the secret principle of the New Unionism would be found, upon ultimate analysis, to consist in the presumption that, as a wage-earner, one man ought to be as good as another. This idea has never been publicly avowed; but it underlies all that is distinctive of the New Unionism. And, as a matter of fact, if the experience of the Gas Workers and Coal Porters is worth anything at all, it goes to show that the mechanic who

has spent years of his youth in acquiring his trade, may be no better off afterwards than a stoker or a coalie who has a monopolist employer to exploit, and a fighting Union to help him do it. It will be interesting to see how the County Council will tread this industrial maze. As soon as the Council assume the status of employer, they enter upon the "accursed inheritance" which Mr. John Burns and his allies have done their best to create by way of warring against the "capitalist." It remains to be seen how John Burns the strike specialist will fit the new part of John Burns the employers' agent. One thing is in favour of the experiment: The times are growing hard, and the most aggressive Unions have well nigh ceased to swagger, while the agitator and the organizer have but a bleak winter to look forward to. It is not likely the County Council Works Committee will be troubled with a strike of their labourers or mechanics until times improve somewhat; and meanwhile a good many things may happen.

Lastly, it would be a mistake to exaggerate the importance of the new departure. The stars will not drop out of their courses because the London County Council have decided to become builders on their own account, and to follow the lead of Glasgow in spending ratepayers' money at first hand upon bricks and mortar. All the same, it is a notable novelty; and its success will be utilized to pave the way for vastly greater things of the same kind. As we have already remarked, it is too late to talk about the principle, in the matter of trading by local authorities with the money of the ratepayers. Whether the "middleman" who has hitherto been regarded as indispensable in the service of communities with the necessaries of life be a general contractor or a gas company, he must justify his existence by reference to practice as well as to theory, or else stand aside.

REGULATING THE PRICE OF GAS IN AMERICA.

From Our American Correspondent.

It has ever been, and probably ever will be, a difficult question to regulate the price of any article which is in the nature of a public necessity, and which, by reason of the peculiar conditions surrounding the manufacture and sale of that article, puts the duty of dispensing it in the hands of a corporation. It matters little whether that article be gas, electric light, water, or even telephone, telegraph, or railroad service, the same rule will hold; and we find a peculiar difficulty in the way of arriving at a price for the article, or for the service rendered, which will be satisfactory alike to the corporation and its customers. In America repeated efforts have been made to regulate the price of many of these commodities by competition; and in no direction has this policy been carried farther than in the gas business, where, as is well known, the wise and learned City Fathers and State Legislators have been wont to cry "Competition is the life of trade"—forgetting that, "where combination is possible, competition is impossible," and disregarding also the laws of political economy which should lead them to see that, in an industry like the manufacture and distribution of gas, there are peculiar conditions which place it on a different footing from ordinary industries of commerce. If the warnings of those most interested in the gas business have not met with fruitful results, certainly experience has been a very efficient teacher; and, as a result, many communities have learnt their lesson, and have looked abroad for some more desirable means to reach their wished-for end. Thus we have had brought to our attention of late several instances where the attempt has been made to regulate the price of gas without resorting to competition. In a previous article (see *ante*, p. 212), allusion was made to the action taken in this direction in Providence (R.I.), where an opposition Gas Company had been trying to get a foothold for many years—making use of all the usual seductive arguments, and holding out promises of better things. But, as noted in the article alluded to, these were of no avail, as the established Company won the day; and a contract was entered into between the City and the Company, which gives the latter the monopoly of the gas business for the next twenty years. It is not necessary to review this case again; it is sufficient to remind our readers that the contract is for twenty years, and that the Gas Company agree to pay to the City 3 per cent. of their gross earnings annually, and to devote their surplus net earnings, after paying 8 per cent. and allowing for the maintenance of the plant, to the reduction of the price of gas. To this summary we will simply add that, at the time the former article was written, the matter was not a *fait accompli*, as the Mayor had not actually signed the agreement. It was generally supposed that he would allow the measure to become law by limitation, without his signature; but such was not the case, for he returned the document to the City Council with his veto. However, the Bill was passed over his objection, and thus became law. The contract in question was made under the provision of chapter 975 of the Acts of the Rhode Island Legislature for the year 1891. It may not, therefore, be amiss, by way of completing the history of the case, to refer briefly to the law in question.

The above-named chapter was passed on May 29, 1891, and is entitled "An Act authorizing Towns and Cities to levy a Special Tax on certain Corporations, and to grant certain Franchises in Highways." The first section of the Act specifies that the city or town authorities may make contracts granting franchises over or under the highways of the town or city, upon the conditions contained in the sections which follow. The next section states in substance that the Act shall apply to gas companies supplying gas for either light or fuel, and to electric light and power companies, as well as to street railways and telephone companies; and that the city authorities may give any or all such companies "the exclusive right, for a term not exceeding twenty-five years, to erect, lay, construct, and maintain, for the purposes for which such corporation is created, poles, wires, pipes, conduits, rails, or cables, with necessary and convenient appurtenances, as may be required for the conduct of the business of such corporation, in, over, or under the streets of such town or city: Provided, however, that no grant of exclusive rights or franchises for either of the purposes aforesaid shall be made by any city or town wherein at the time a corporation created for the same purpose, or a person duly authorized by law to use the streets for such purposes, shall be in actual use and enjoyment of such rights, except to such corporation or person already carrying on business in such city or town." Then follows a provision that, if more than one corporation shall be engaged in the same business in any city or town, no exclusive right shall be granted to either without the consent of the other. After this comes another provision that the law shall not prevent a person or corporation from using such streets for the purposes specified, "in order to connect and serve any two or more estates owned by such person or corporation." Section 3 calls upon every corporation accepting the provisions of the Act to render to the Town Treasurer a quarterly statement, verified by the oath of its Treasurer, of its gross receipts; and it specifies that it shall at the same time "pay to such Town or City Treasurer, in full payment for the rights and franchises aforesaid, a special tax upon the gross earnings at a rate not exceeding 3 per cent. upon the gross earnings of the corporation within the town or city within such year. In case any such corporation shall neglect to make payment of such quarterly tax as aforesaid, said Town or City Treasurer may collect and recover of said corporation, as other taxes are collectable, double the amount of the special tax shown to be due by the last preceding quarterly return of such corporation." In case a corporation does business in more than one city, and the earnings cannot be separated, then its gross earnings as applicable to one town shall bear the same ratio to its total gross earnings as the length of wires or conduits in the town bears to the total length of wires or conduits operated by the company. Section 4 provides that no corporation accepting the Act shall, during the continuance of its contracts, charge a greater price for its wares or services than it is charging at the time the contract is made. Section 5 says that the franchise is accepted subject to such reasonable rules and regulations as the city authorities may make from time to time, regulating and controlling the location and arrangement of its tracks, poles, or conduits; the "reasonableness" of the rules and regulations to be determined by the Supreme Court, in case of any difference of opinion on this point. Section 6 provides that a city or town shall not make any additional charge to the corporation for the use of the streets, except that it may require any street railway company to continue to conform to any existing rules as to paving and keeping in repair the streets over which the rails run. The foregoing is, in brief, the Act under which the Providence Gas Company have made their contract with the authorities of the City; and we have deemed it worthy of this notice as it is a unique piece of legislation as far as America is concerned. It will not be very far out of the way to say that this is equivalent to a tax of from $80 to $90 a year per mile of main. However, as remarked at the outset of this article, there have of late been several instances where the price of gas has been fixed for a term of years; so we will hasten on to allude to another case—leaving all comments on the individual cases till the close of the article.

The next instance to be considered is the City of Cleveland (Ohio). In dealing with this case, it may be said at the outset that in the State of Ohio, as in some other States, the City Government has the authority to determine at what reasonable price gas shall be sold within its territory. It has been found out, by experience in this and similar instances, that a great deal depends on the word "reasonable." This, however, is anticipating the statement of facts. In the City of Cleveland, the charge for gas was, up to within recent times, $1 per 1000 cubic feet—certainly a very moderate price; in fact, it was only made at all possible by the fact that coal can be laid down in Cleveland at a low rate. But the city authorities evidently felt that the figure named was excessive; and so, in the first half of last year, they passed an ordinance that the price of gas supplied by the Cleveland Gas Company and the People's Gas Company of the same city should be fixed at 60 c. This ordinance was put through first without allowing the Companies to be heard; but afterwards, when it was found necessary, in order to fully comply with the statutes, to make haste with less speed, an audience was given, which was certainly *pro formâ*, and another ordinance was passed fixing the price as in the former one. Against this vote the two Companies—each of whom supplied separate portions of the city—entered a determined protest, declining to be governed by it, on the ground that the price was not reasonable; and they appealed to the United States Circuit Court for a temporary injunction

against the city authorities, to prevent them putting the ordinance in force. The case was brought before the United States Court rather than one of the State Courts, because it was held that the ordinance was in the nature of a confiscation of property, inasmuch as it tried to compel the Company to sell their goods at an unremunerative rate, and was therefore against the provisions of the Constitution of the United States. The case was heard at some length; and much testimony was introduced by the officers of the Company and the experts called by them, to show that at the price named in the ordinance the Company could not make any return on their capital, and therefore it was an attempt to take their property or render its value less, without due process of law. The evidence practically hinged on this point—whether or not gas could be supplied at the price named with a reasonable profit. The judgment in the case was given by Judge Jackson in November of last year; and it was evident he thought the petitioners had established the fact that 60 c. was not a reasonable price, as his decision was in favour of the Company. It is impracticable to quote the decision *in extenso;* but a few brief quotations therefrom may be interesting:—

> The constitution and laws of the United States made in pursuance thereof are the supreme law of the land. We are all citizens of a dual Government—State and Federal. The people of the States made the General Government, and conferred upon it its power; and they have expressly said, in the constitution of the General Government, that that constitution, and the laws and treaties made in pursuance thereof, shall be the supreme law of the land. . . . This, as already stated by the Court, is one of the most important questions that the Court has had before it for years. It is the great question of the future—as to how far legislative authority, the Legislatures of States and Municipalities acting under legislative authority, may, under the guise of legislation, attack the property of individuals or corporations.

The Court goes on to say, in effect, that the Cleveland Gas Company was chartered by the State of Ohio in 1846; that it provided that, before commencing business, it should secure the right from the City of Cleveland to lay its conduits; that it did secure such right; and that, the Company having accepted such rights and laid down its pipes, the city could not withdraw its consent. In the charter of the Company, there is necessarily implied the right to charge a reasonable price for the gas to be supplied. The constitution of the State of Ohio then contained no provision to repeal or modify a charter granted; and the Judge held that the new constitution adopted by the State in 1851 could not be retroactive, and therefore did not affect the case, nor did the law subsequently passed give the municipal authorities the right to regulate the price of gas in an arbitrary manner. The Judge then proceeds to say that the complainant states, as a matter of fact, that it cannot supply gas at less than $1 per 1000 cubic feet, and claims that this is a taking of their private property without due process of law. He then says:

> The question that now faces the Court is whether a Municipal Corporation, itself a large consumer of gas, has the constitutional right to fix the price at which itself and other customers shall pay for gas. The Court has no doubt, therefore, that a federal question, and one of the most serious character, is presented in this bill. It entertains no doubt about its jurisdiction to award the relief asked; and it entertains no doubt whatever that, under the facts stated in this bill, the relief that is asked should be granted, and that the Council of the City of Cleveland should be enjoined from the enforcement of that ordinance on the case made in the bill. That will be the judgment of the Court.

It might be supposed, at first reading, that so sweeping a decision would have settled the controversy. But it was still open to the city to appeal to the Supreme Court of the United States; and, as long as there was any chance for fighting, it was but natural that the fight should continue. We therefore find the city declining to pay its gas bills, except on the basis of 60 c. This the Gas Companies, of course, refused; and finally we find oil taking the place of gas in the public buildings. The gas public, however, felt the Companies had the best of the fight up to date, and would continue on the lines laid down by holding to their declaration to the effect that they could not afford to sell gas for less than $1 per 1000 cubic feet. Certainly other gas companies hoped that the Cleveland corporations would hold firm; fearing that any serious reduction in this case, which had attracted the attention not only of gas companies but of municipal authorities far and wide, would lead other city councils to clamour for lower prices from their respective gas companies. However, the Cleveland corporations argued that they were fighting their own case, and could not afford to jeopardize their own interests for the benefit or the possible benefit, of their *confrères* in the business—in other words, that they must act entirely in accordance with what seemed to be for the interests of themselves, and not be influenced by the possible effect of their action on other gas companies. As the Managers of the two Cleveland Companies determined that it was to their interest to make some kind of compromise, rather than pursue a course which would lead to increased bitterness between themselves and the city authorities, we find, in June of the present year, the City Council passing an ordinance of which the following was the preamble:—

> Whereas the Cleveland Gaslight and Coke Company and the People's Gaslight Company have submitted to this Council, under date of the 31st of May, 1892, the following proposal—to wit: "We submit to the city the following proposition for a settlement of the present contention between us and the city as to the price of gas, and all litigations now pending: that is to say, (1) We will accept an ordinance fixing the price of gas for the period of ten years at 80 c. per 1000 cubic feet, and also requiring the payment by us of 6½ per cent. of the gross income from sales of gas into the city treasury semi-annually; (2) the city to pay us for gas consumed since May 1, 1891, at 80 c. per 1000 cubic feet; (3) we to pay the court costs in pending litigation, including *quo warranto* proceedings, and also the amount of $134, expenditure made by you in connection with our litigation"—now, therefore, be it ordained, &c.

The ordinance then goes on to recite that the price of gas furnished by the two Companies in question shall be 80 c. per 1000 cubic feet for the period of the ensuing ten years, and that the Companies shall pay to the city, semi-annually, a sum equal to 6½ per cent. on the gross earnings from gas. The ordinance next states how the books of the Companies shall be kept, and specifies that they shall be open to the inspection of the City Auditor, who shall also have authority to appoint a suitable expert to examine the books of the Companies whenever, in his opinion, it is necessary so to do; and if, on the report of such expert, the reports of the Companies are not found to be correct, then such reports are to be corrected, and the payments made on the basis of the corrected reports. The ordinance then provides that the gas shall be of 18-candle power, as tested by the burner "of a lava-tipped Bunsen Argand pattern;" the gas to be tested semi-weekly, and the result of the test communicated to the Companies within 24 hours after it shall have been made. The gas is to be delivered at the burner of the consumer at such pressure in the mains as shall be consistent with the proper distribution of the gas throughout the entire system of mains in the city; and the degree of pressure is to be at all times "wholly subject to, and under the control and direction of, the Director of Public Works," and all governors, meters, and works of Companies are to be at all times "subject to the inspection of the proper officer to be designated by the Director of Public Works for such purpose." Section 5 specifically provides that, under the ordinance, the city is not required to patronize the Companies in the matter of lighting the streets or public buildings, but is free to light them in any way it may desire. The passage of this ordinance, and its acceptance by the Companies, practically fixes the price of gas in Cleveland for the next ten years; and here we have another method of agreeing on the price of gas.

Des Moines (Iowa) offers another example of the Municipal Authorities trying to determine the selling price of gas; but in this case the Gas Company has so far had the best of the fight. The facts are briefly these: The price of gas is $1·80 per 1000 cubic feet, with a discount of 10 c. for prompt payment; leaving the net price $1·70. On Feb. 22 of the present year, the authorities passed an ordinance fixing the price at $1·25, or, with discount, $1·15 net. The Company declined to be governed by this piece of legislation, and continued to send in their bills at the old figure. Hence one of their customers brought an action to compel them to charge according to the ordinance. Much expert evidence was introduced by the Company at the trial, to show that the price fixed was an unreasonable one, and was therefore equivalent to the confiscation of private property. They showed by the figures given by their officers that in 1878 the business was done at a loss of $508 for the year; that in 1886 the cash invested in the business was $273,854, while the year's profit was only $21,197, or 7¾ per cent.; that in 1891 the cash invested in the works had risen to $449,500, and that the profit was $24,053, or 5·35 per cent.; and that the Company also had $100,000 in an electric lighting plant which was not included in the foregoing figures, and was not returning them anything in the shape of interest. They showed further that the cost of making and distributing gas last year was $1·06 per 1000 cubic feet; and as the ordinance fixed the price at $1·15, the profit would only be 9 c., or 1 per cent. on their investment. Their counsel claimed that, as they had carried on the business for many years with a very small average dividend, they were now entitled to something more than might at first sight seem a fair rate of interest, in order that they might recoup themselves for the small gains of the past. Instead of allowing them to do so, however, the present ordinance would require them to sell gas at a price which would really give them no return whatever on their investment; and this was practically "taking their property without due process of law." One of the officers of the Company was asked why gas could not be supplied as cheap in Des Moines as in Wheeling (West Virginia), where the works are owned by the city. The witness, in reply, showed that his Company paid the city 11·3 c. per 1000 cubic feet in taxes, whereas the Wheeling works were exempt from such a charge; and, further, that gas coal in Wheeling cost only $1·58, whereas in Des Moines the price was $5·23. Hence there would be a difference in this charge alone of 36 c. per 1000 cubic feet. Further, Wheeling sold 115 million cubic feet of gas a year, whereas the Des Moines Company distributed only 52 millions; and this would, in the opinion of the officers, make a further difference of 10 c. Then there were other points of dissimilarity which would bring the cost of gas in the latter city to 59 c. in all more than in the former place; and consequently a comparison between the two cities was not a fair one. The decision of the Judge was that the price specified in the ordinance was not a reasonable one, and that the fixing of it was therefore illegal.

In Massachusetts, an instance has occurred of an attempt being made to fix the price of gas by an altogether different method. In this case the seat of war is Boston, and the adjudicating body the Board of Gas Commissioners. It may be remembered that Boston was the scene of a very determined

gas fight rom 1884 to 1889; the parties to the contention being the old Boston Gaslight Company and its youthful rival, the Bay State Gas Company, controlled by Mr. Addicks. During the fight, the former Company, in order to protect themselves against the loss of their largest customers, made contracts with them, agreeing to supply them with gas at $1 per 1000 cubic feet; the selling price being $1.30. These contracts ran out about a year ago; and the Bay State Company, having in the meantime succeeded to the management of the old Boston Gas Company, have insisted on their customers paying the full price of $1.30. This they have done, but with very poor grace, as would naturally be expected; and they have now petitioned the Board of Gas Commissioners to the effect that the Company shall be compelled to reduce the price of gas to $1.

It would appear from the foregoing that the price at which gas is to be sold is exciting more than ordinary interest in America, and that several methods are being used to determine what this price shall be. The scheme which has been worked out at Providence is in many ways a fair one; for, on the one hand, it gives the Company a monopoly of the business for a long term of years, while, on the other, it prevents them from raising their charge. There is, however, a question of policy involved here, as also in the Cleveland instance; and that is whether a company should pay over a portion of their earnings to the city in which they do business. Why should the city and a gas company enter into a partnership of this nature? It must be confessed that this question has not yet been satisfactorily answered. It would appear to be a more fair and equitable plan, instead of paying this amount to the city at large, to give it to the gas consumers in the form of a reduction in the price of gas. On theoretical grounds, certainly, it would seem that this sum belongs to the consumer; and there is no reason why he should be taxed to the extent of an extra 5 c. on every 1000 cubic feet of gas he uses, in order to lighten the taxes of someone else who does not burn gas. It is a case of unjust and unequal taxation, and is therefore not sound from the standpoint of the political economist. But the practical gas manager must needs face facts, not theories; and he is confronted by the prevailing passion for trying to make all corporations using the streets pay to the city a portion of their earnings. The scheme is very enticing to the average politician. It appears to him to involve getting something for nothing; and as it is the ruling fad in the "popular legislation" of the day, it is hardly to be expected that the gas manager, who must protect the life of his corporation, should fight it off on theoretical grounds.

There is another point, in both the Providence and Cleveland cases, which calls for notice—viz., the fixing of the price of gas so as to prevent its being raised above a certain figure for a term of years. In the former case, the price can be reduced (it must be, under certain conditions), but it cannot be raised above the present rate. By the Cleveland ordinance, the charge is fixed positively for ten years. But what would the effect be if the price of labour and supplies, which go to make up the cost of gas, were to be largely increased? We do not perceive in the air the odour of burning gunpowder, and do not anticipate that America will be plunged into war during the next decade. But the raising of prices on supplies is one of the possibilities for which these schemes do not provide; and if there is no real danger from this source, there may come trouble from the industrial revolutions in progress in the country. The tendency of the day is to higher prices. Manufacturers combine, and form "trusts" to curtail manufacture and maintain or advance prices. We have the coal companies now engaged in forming one of the most gigantic of trusts; and we are treated at pretty frequent intervals to notices of a rise in price of this necessary article. We have Congress effectually building a wall round the country to prevent competition from outside. The wage-earner is clamouring for his share, and more, of the enhanced prices; and he is combining with his fellows for higher wages and shorter hours. How far these tendencies may be allowed to go unrestrained, we cannot say; but they offer a possible argument against a gas company binding itself down to a hard-and-fast price for a term of years. However, as against these possible dangers, the Providence and Cleveland Companies secure present and tangible advantages. The former concern is particularly fortunate in securing the monopoly of the gas business for twenty years, and thereby being ensured against legislative fights by projectors of new undertakings. We must, however, confess to a leaning towards the Massachusetts plan, which places the whole subject in the hands of the Board of Gas Commissioners, who are three gentlemen appointed by the Governor of the State each for a term of three years; for here, if the Commissioners fix a price which the changed conditions of the country subsequently show to be unjust, it is possible to revise the figure, and make it fair and equitable. It is desirable, however, to see established a closer relation between selling price and dividend. One would like to see it made to the interest of the gas director and the gas shareholder to lower the price of gas. We have, of course, in mind the English sliding scale; and we hope to see some modification of it adopted in America. In the meantime, the scheme of having the price fixed by an impartial board, like that of the Gas Commissioners, seems to be far preferable to having a City Council legislating as to what the price of gas shall be, or to having it made the subject of a hard-and-fast contract between the city authorities and the local gas company.

ELECTRIC LIGHTING POPULARLY EXPLAINED.

From the offices of our useful contemporary the *Electrical Review*, there has been issued a shilling pamphlet which professes to treat of the application of electricity to the lighting of private houses from the point of view of the user.* Quite a library of self-styled popular manuals relating to electric lighting already exists; so that if supply creates demand in this, as in some other fields of industrial enterprise, there should be a well-developed public appetite for such information upon this subject. The worst of the matter is that electricity, whether regarded as a science or as a useful servant of a modern civilized community, has so often been handled by writers who have apparently been persuaded of their fitness for the task by reference to the saying, "Among the blind, the one-eyed is king," that one is suspicious of all attempts to "popularize" the subject. Moreover, when a handbook proclaims upon its cover and title page that it is written from a certain standpoint, the question naturally arises as to how this particular position has been attained. In the pamphlet before us, Mr. de Segundo pretends to write not for consumers of electric light—the term "consumer" is very awkward in this connection—but actually as a consumer, which is surely rather daring on his part. It implies a presumed ability to put himself in somebody else's place, which is not common, even among engineers, who are as a body capable of doing many wonderful things. Besides, what can the average user of electric lighting be supposed to know about it, beyond the amount of his bills? The fact of the matter is, as may be supposed, that Mr. de Segundo, whatever his title-page may say, writes as an engineer and an expert in electric lighting, and endeavours to tell the prospective user of it just what he, the expert, thinks the latter ought to be told by way of assisting him in making up his mind to adopt this method of lighting his house. Thus the first chapter starts by explaining that rooms lit by gas or oil soon become "stuffy," while "in rooms electrically lighted this discomfort is entirely absent." Just so. Of course, no smoking-room, even, needs to be ventilated provided only it is lit by incandescent electric lamps!

We are naturally curious to see how Mr. de Segundo treats the delicate question of cost. Here he skates very neatly over the thin ice through which the less volatile resident in an electrically lighted domicile is apt to plunge. It is easy enough to expatiate upon the handiness of electrical stopcocks, and the advantage of not having the house cleaned and decorated so often, when one is talking to a householder. But since our author essays to write as a user, why does he not, as the lawyer's say, "state an A and B case"? Why not give his readers authentic references to bills actually run up and paid in different localities? Deprived of this datum of actuality, Mr. de Segundo's work sinks at once to the level of an ordinary electricians' puff; and as such exempts itself from criticism.

Mr. George Barker, lately with the Sheffield United Gaslight Company, sailed for Monte Video last Saturday week, having been appointed Draughtsman and General Assistant to the Monte Video Gas Company, Limited.

High-Power Burners for Public Lighting in Paris.—Our readers are aware that lamps fitted with high-power burners are very liberally employed for the public lighting of Paris. One of the latest and best types introduced is the "Industriel," of which 1000 have been installed. The completion of this number was recently signalized by the makers (MM. Bengel Frères).

An Artesian Boring a Quarter of a Mile Deep.—A very deep boring of considerable interest to geological research, for which object it was carried out, has just been successfully brought to a completion at Mickleton Manor, Gloucestershire, by Messrs. Le Grand and Sutcliff, of London. After passing through about 121 feet of middle lias, marlstone, sand, and shales, the lower lias clays and limestones proved to be 1120 feet thick. Below these came the rhætic beds, and at 1315 feet the Keuper marls were reached, into which the boring penetrated 27 feet; gypsum being found in the last 2 feet. The total depth of the boring is thus 1342 feet, or upwards of a quarter of a mile.

Wind Power and Water Supply.—Under the direction of Messrs. J. Taylor and Sons, of Westminster, an interesting application of wind power has recently been made for the water supply of an estate at Backwell, near Bristol, where hitherto great difficulty has been experienced in getting a sufficient service on account of its elevated position. One of Messrs. Alfred Williams and Co.'s "Halliday" windmills has been erected, and water is now taken from the Bristol Water Company's main, which supplies a tank situated at a level 190 feet above Ordnance datum; being the foot of the hill approaching the estate. The windmill is placed over this tank, and is coupled direct to the pump. The lift from this point is 360 feet, through 2500 feet of pipe; and the water is delivered into a storeage tank of about 6000 gallons capacity, from which it flows to the mansion.

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* "Domestic Electric Lighting, Treated from the Consumer's Point of View." By Ed. C. de Segundo, Assoc.M.Inst.C.E. London: H. Alabaster, Gatehouse and Co.; 1892.

NOTES.

An Outdoor Albo-Carbon Lamp.

At the last meeting of the Société Technique du Gaz en France, one novelty shown was an albo-carbon lamp arranged for use in public lighting. It was constructed according to the designs of M. Bénard; and it is illustrated in the current number of the *Journal des Usines à Gaz*. The working portion of the lamp is much the same as in the case of the lamps of this class employed in interior lighting—the burners projecting from a central pipe rising from the reservoir containing the carbon, and the flames heating a metallic plate above them. The carbon is inserted through a capped orifice at the side of the reservoir; and a flash-light is provided. The smallest type of the new lamp has eight burners, consumes 21 cubic feet of gas and 540 grains of carbon per hour, and gives the light of 142 candles. The next size has nine burners, consumes 28 cubic feet of gas and 830 grains of carbon per hour, and gives the light of 275 candles. The largest size has 15 burners, consumes 35 cubic feet of gas and 1620 grains of carbon per hour, and gives the light of 313 candles. It is scarcely necessary to discuss here the merits of the new lamp as an appliance for public lighting. In certain positions it would, no doubt, be very effective. One has been erected on the Place Marcadieu, at Tarbes; and it will afford an opportunity of ascertaining if the albo-carbon system lends itself to outdoor lighting, if it is capable of standing against inclement weather, and what are the expenses attending it as compared with gas alone.

Effect of Punching on Soft Steel.

At a recent meeting of the Civil Engineers' Club of Cleveland (Ohio), Professor C. H. Benjamin described some experiments he had made on the effect of punching on soft steel. They were made in the mechanical laboratory of the Case School of Applied Science, under the direction of Mr. Benjamin, and had for their objects, first, the determination of the ultimate resistance to shearing of soft steel plate for different forms of punch; secondly, the determination of the effect of the punching on the elastic limit and ultimate tensile strength of the plate in the various cases. In every test, the material used was Otis steel boiler-plate, ½ inch thick, and stamped 60,000 lbs. tensile strength—the pieces all being cut from the same plate. The experiments showed that the average resistance to punching with the common forms of punch was 50,000 lbs. per square inch; while with the spiral punch it was only 38,000 lbs. Also that punching a plate with the ordinary form weakened it 7½ per cent.; while the use of the spiral punch only weakened it 3 per cent. A considerable change in clearance affected the results but slightly; but good or bad centring of the punch and die was very noticeable in its effects.

A New Oil-Field.

The Colonial Secretary at Singapore, in a recently issued report dealing with the kerosene trade of the colony, mentions a new oil-field, for some time known, but only lately become productive, in the northern part of the island of Sumatra. It appears that concessions have been granted by the Dutch Government to both Dutch and English capitalists; but so far a Dutch company is the only one which has commenced work. Having started only within the last twelve months, it is now reported to be producing from 15,000 to 20,000 cases per month, with a steadily increasing output. Altogether, concessions have been granted for some 320 square miles of what has been pronounced by experts to be a very rich oil-producing territory; and being on the sea-coast, and not, like the American and Russian oil-fields, far inland, and having besides an excellent deep-water, well-sheltered harbour, its position may be said to be unique. The kerosene produced is reported to be of first-rate quality, being "water-white," absolutely without "bloom," flashing by Abel's test at 83° to 86°, and burning at 124° to 126°; the percentage of kerosene yielded being fully equal to good American, and quite double that of Russian petroleum.

A Suspended Water-Main.

Some time ago, the conduit under the Sarine River, supplying water to Friburg, Switzerland, was partly destroyed; and it was necessary to immediately repair the damage, since the inhabitants depended largely on this particular water for the supply of their domestic and manufacturing requirements. A suspension structure was put up to carry the temporary conduit over the river; and a description of the arrangement, translated from a local paper, appeared in a recent number of the *Engineering Record*. The bridge had two side spans, of 56 and 64¼ feet respectively, and a centre span of 77¾ feet. Two rough piers of cribwork filled with stones formed the supports. The structure was so designed that the main longitudinals of the bridge would act as ordinary timber lattice girders as long as the supports remained in position. They were liable to be washed away at any time, however; and, in that case, the structure, which would have a single span of 210 feet, would be supported entirely by the cables. The two suspending cables were each composed of three wire ropes, two made up of 50 strands, and the third of 70 strands of No. 18 B. W. G.; and these, after passing over the saddles, were attached to the anchoring cables, which were each made up of 200 strands of the same gauge. The vertical suspension-ropes attaching the platform to the cables were made up of No. 16 wire, varying from 8 to 14 strands in section, and were spaced 8 ft. 2½ in. apart. The platform was composed of two latticed longitudinals, divided into bays of 6 ft. 7 in., and braced together above and below by transoms and diagonals, forming, in section, a square about 6 ft. 7 in. side. Guy-ropes were attached to the sides of the structure, at a distance of 65 ft. 7 in. from each bank, which would come into service should the supplementary piers be removed. The water conduit was formed by a line of cast-iron flanged pipes of 1 ft. 3¾ in. internal diameter. The metal was 1 inch thick; and the castings were 13 feet long, and weighed 2225 lbs. The pipe flanges were connected by 16 bolts, except at the ends of the bridge, where the connection with the trenched pipes was made by a special joint with india-rubber ring. To guard against frost, the pipes were encased in wooden boxing, packed with moss, beech-leaves, and wood-shavings. The total weight of the bridge was 39¾ tons; and its cost, exclusive of the water-pipes, was $2810.

Acid-Resisting Paint.

Mr. Rudolph Lender has lately taken out a patent for the preparation of a paint which, it is stated, can be used as a sure preservative of metals from rust, &c. When applied to sheet iron, it was found that the coating was unaffected by warm water or steam, or by the action of acid and alkaline liquids, ammonia gas, hydrochloric acid gas, and sulphuretted hydrogen gas. The principal ingredient in the paint is a silicate of iron which is found in the neighbourhood of natural deposits of iron ores, and also occurs in veins, in deposits of granite, which have become decomposed by contact with the air. The deposit, which is employed in the form of a finely-ground powder, is found to have the following composition: Silicic acid, 5·4; phosphoric acid, 0·05; oxide of iron, 88·65; alumina, 0·5; lime, 1·75; magnesia, 1·35; and undetermined elements, 2·3. The silicate of iron in a very finely-divided state is mixed with oxidized linseed oil and varnish, to form a paste. When required in the form of paint, it is thinned down with good linseed oil, to which, if deemed desirable, a drier, such as litharge, is added; and at the same time mineral colours, to produce the required shade, are introduced.

The Utilization of Ammoniacal Liquor as Manure.

M. Schlœsing has lately communicated to the Academy of Sciences a note by the Marquis de Vogüé on the subject of the fixation of the nitrogen in ammoniacal liquor by straw. The liquor from neighbouring gas-works was used for the irrigation of certain fields; but the quantity produced becoming greater than he could conveniently deal with, it occurred to him that it would be possible to fix the nitrogen upon some organic materials capable of being stored and used as required. He accordingly tried an experiment with the straw of oats, and succeeded in obtaining a particularly rich manure. M. Schlœsing thought the results worthy of the attention of agriculturists. In noticing this matter, the Editor of *Le Gaz* expresses his concurrence with this view, and remarks that gas managers might induce farmers in the vicinity of their works to make a trial of the liquor on the lines above indicated. It would be worth while to make with straw, dried leaves, and worthless grass, composts capable of fixing the nitrogen in ammoniacal liquor; the heaps of manure thus formed being periodically drenched with the liquor. In agricultural districts where difficulty is experienced in getting rid of liquor, this new outlet for it may be favourably regarded by gas managers.

Analysis of Coal-Tar Preparations.

According to the *Chemical Trade Journal*, the latest investigations by Messrs. Helbing and Passmore refer to the valuation of disinfectants prepared from coal tar. They state that, since the bactericidal properties of these preparations reside in the phenoloid bodies contained therein, the chemical estimation of such bodies is a measure of their activity, so that a bacteriological examination becomes unnecessary. Tar oils contain certain acids (so-called), bases, and hydrocarbons, which are more or less present in preparations made from them. A method of chemical analysis applicable to the one is, therefore, suited to the other within certain limits. For determining the hydrocarbons (benzene, anthracene, naphthalene, &c.), the acids in 50 grammes or more of the oils are fixed and removed with 10 per cent. of caustic soda solution; the oils having first been diluted with an equal volume or more of ether. The ether dissolves the hydrocarbons and bases; and the small quantity of the latter, washed out by the soda, is also removed with ether from the alkaline liquors. The combined etheral liquids are next washed with 1 to 4 sulphuric acid to remove the bases, after which the ether is treated by washing and evaporation for hydrocarbons. The acid constituents of tar oils are phenol and its homologues. Strictly they are not acids; but they associate themselves readily with the soda in the preliminary treatment, and are to be sought for in the alkaline liquors. The process which Messrs. Helbing and Passmore suggest for this is simple—viz., to acidify with sulphusic acid and extract the acids with ether, which on evaporation yields a residue of the phenoloid bodies. It is impossible, the authors say, to separate carbolic acid from its homologues by practical distillation, owing to the close proximity of their boiling points; and the only method which they found practicable was to fractionally precipitate the alkaline solution of tar acids with small quantities of mineral acid, whereby the carbolic acid is concentrated in the first fraction.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

The Testing of Crude Gas.

(*Continued from p.* 549.)

For the thorough understanding of the tests referred to in the preceding chapter, the student cannot do better than work them out for himself; carefully following the instructions here given, or those usually supplied with the test apparatus. An illustration, applied to all of the tests described, may be helpful; and we will therefore suppose that we have to deal with a gas which, on investigation, is found to contain the following approximate quantities of the impurities named:—

H_2S.	about	700	grains per 100 c. ft.
CS_2 (and other sulphur compounds)	,,	20	,, ,,
NH_3.	,,	1	,, ,,
CO_2.	,,	1·5	per cent.

It is not usual at this stage to test for sulphur compounds other than sulphuretted hydrogen; but bisulphide of carbon may be roughly estimated by Harcourt's colour test as follows: Test for sulphuretted hydrogen as directed; then test again with another sample of gas, and using the platinized pumice bulb. Any difference that may be observed should be due to the sulphur, which, originally present as bisulphide of carbon, is now decomposed, by the heated platinized pumice, into sulphuretted hydrogen. Or, better still, pass the gas through an experimental oxide purifier, by which the sulphuretted hydrogen may be eliminated. The gas may then be tested for bisulphide of carbon alone.

We will now go on with the examination of the gas above referred to; testing first for sulphuretted hydrogen. (*a*) A preliminary test with the lead acetate paper will, by immediately blackening the paper, indicate large quantities of the impurity present. Then proceed (*b*) by Harcourt's test. Pass the gas through the solution direct; the water from the aspirator will indicate in the measuring cylinder the quantity of gas used in the test. The standard colour solution is such as to require 0·0025 grain of sulphur to alter the test solution to the same tint. Two measuring cylinders are supplied—one divided into 2000ths, and the other into 20,000ths of a cubic feet, and used when large quantities of the impurity are present. The latter will be required in this case; and will, at the close of the test, be found to be filled with water up to the seventh division—*i.e.*, 7·20,000ths, or 0·00035 of a cubic foot of gas has passed through the test, and (according to the above) it contained 0·0025 of a grain of sulphur as sulphuretted hydrogen. If 0·00035 of a cubic foot of gas contains 0·0025 grain of sulphur, how much will 100 cubic feet contain?

$$\frac{100 \times 0{\cdot}0025}{0{\cdot}00035} = 715$$

There will consequently be 715 grains of sulphur as sulphuretted hydrogen in 100 cubic feet of gas.

The student may find that certain foreign matters contained in the crude gas will seriously interfere with the satisfactory comparison of the tints in the two solutions. By passing the gas through cotton wool, or washing it with water, prior to testing, he will probably dispose of this difficulty; but whatever course he may adopt, every care must be taken that, before he commences a test, the washing or cleansing medium is *fully saturated* with the impurity with which he is dealing.

We will now test by Wanklyn's method. (*c*) Fill the gas bottle by displacement. This when full is equal to 1-10th of a cubic foot. Fill the hollow stopper with test solutions equal to 2½ oz. or 40 divisions of the burette, which is graduated into 1-16th oz. divisions. This solution is of such a strength that each 1-16th of an ounce of it will neutralize 1-100th of a grain of sulphuretted hydrogen. Each 1-16th of an ounce, when used with the 1-10th of a cubic foot bottle, therefore corresponds to 10 grains of sulphuretted hydrogen per 100 cubic feet of gas—

$$\frac{100 \times 0{\cdot}01}{0{\cdot}1} = 10$$

Well shake up the solution in the gas bottle. Withdraw the stopper, reject a small quantity of the saturated liquid, and add (say) 10 more divisions of the test solution. Insert the stopper in the gas bottle, and shake up again. Then allow the liquid to drain into the stopper, and withdraw. Pass the bottle over an upright file on which is vertically fixed a lead acetate paper; and the paper is immediately blackened. Add more solution, and again shake up in the bottle. Then test as before. Repeat the operation again and again; adding each time one or more divisions of the solution, and using a fresh paper for every test until the latter refuses to darken. The quantity of solution used, as read off on the burette, is 71 divisions, which will represent $71 \times 10 = 710$ grains of sulphuretted hydrogen per 100 feet.

With regard to bisulphide of carbon, not indicated by the lead acetate paper, it is very doubtful whether a test for this impurity can be here satisfactorily made; but if it is to be attempted, proceed by Harcourt's test, as indicated above. Eliminate the sulphuretted hydrogen by oxide of iron; and pass the gas through the test for bisulphide of carbon. The larger measuring cylinder will be used; and, on the completion of the test, it should be filled to the 25th division—indicating that 25·2000ths, or 0·0125 of a cubic foot of gas has passed through the test, and contained 0·0025 grain of sulphur. Hence—

$$0{\cdot}0125 : 100 :: 0{\cdot}0025 : 20$$

Or 20 grains of sulphur as bisulphide of carbon in 100 cubic feet of gas.

For ammonia, first test with moistened turmeric or reddened litmus papers, which become discoloured, indicating the presence of ammonia. The Wanklyn method, already described, depends for its ultimate result upon the Nessler test. This, however—especially adapted for water analysis—is but little, if at all, used in gas-works laboratories; and to trouble the student further with it is therefore unnecessary. The usual method employed in gas-works for quantitatively testing for ammonia is the Referees' acid or neutralization test (to be fully explained when dealing with the analysis of purified gas).

For carbonic acid: (*a*) Pass the gas through a little baryta water. The liquid is rendered opaque, and the presence of the impurity is thereby indicated. (*b*) Proceed by Harcourt's test, as already described. The measuring cylinder (the smaller one) is filled with water to the 48th division. The standard liquid contains an amount of suspended barium carbonate, in such quantity that, if the test solution be rendered equally opaque with it by a quantity of gas represented by one division of the cylinder, the percentage of carbonic acid present would be 72; if 10 divisions were required, 7·2; if 100 divisions, 0·72; and so on. Therefore—

$$48 : 10 :: 7{\cdot}2 : 1{\cdot}5$$

Or 1·5 per cent. of carbonic acid. (*c*) By Wanklyn's method, 1-10th of a cubic foot of gas is collected in the gas bottle as before, and washed with a saturated solution of baryta water, when carbonate of barium ($Ba CO_3$) is precipitated. This is filtered off, dried, and weighed. The weight in this case will be found to be 5·48 grains. Now, for every 196·65 parts by weight of carbonate of barium, 43·89 parts will be carbonic acid (CO_2), or 1 part by weight of $Ba CO_3$ will yield 0·2233 part of CO_2. Therefore—

$$1 : 5{\cdot}48 :: 0{\cdot}2233 : 1{\cdot}22;\ \text{or}\ 196{\cdot}65 : 5{\cdot}48 :: 43{\cdot}89 : 1{\cdot}22$$

That is, 1·22 grains of carbonic acid in 1-10th of a cubic foot of gas. Then $1{\cdot}22 \times 10 \times 100 = 1220$ grains per 100 cubic feet, or 1·494 per cent.*

(*To be continued.*)

The Dangers of Natural Gas.—According to a telegram received through Dalziel's agency, an explosion of gas took place in the works at St. Mary's (Ohio) on Saturday, the 15th inst., by which six persons were killed.

The Coal Contracts of the Leeds Corporation Gas Committee.—At last Thursday's meeting of the Leeds Corporation Gas Committee, tenders for 66,000 tons of coal were accepted, at a reduction of from 6d. to 7d. per ton on the last contract price.

Fatal Accident at the Nottingham Gas-Works.—An inquiry was held last Tuesday by the Borough Coroner of Nottingham into the circumstances attending the death of William Lockwood, who had been in the employ of the Corporation at the Basford Gas-Works during the past 17 or 18 years. It appeared from the evidence that deceased (who was 56 years of age) was at work on the railway siding on the previous day, when he caught his foot in the points; and before he could extricate it, a loaded truck ran over him. He died in the hospital shortly after noon the same day. The jury returned a verdict of "Accidental death."

Sales of Shares.—At a sale of stock and shares at Leeds last Tuesday, 40 £10 fully-paid shares in the *Castleford and Whitwood Gas Company* sold for £740, equal to £18 10s. each. For £400 of 5 per cent. stock in the *Scarborough Gas Company*, only £130 per cent. was offered; and the lot was withdrawn.——On the previous day at Sheffield a number of new "F" shares in the *Sheffield Gas Company* realized £2 9s. apiece.——At the Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards sold six fully-paid £10 "B" shares in the *Harrow District Gas Company* for £74; £370 "A" stock of the *Tottenham and Edmonton Gas Company* for £814; £160 "B" stock of the same Company for £269; and £300 "D" stock of the *Hornsey Gas Company* for £420.

The Bradford Corporation Gas, Water, and Electricity Accounts.—The annual volume of the Bradford Corporation finances for the year ending March 31 last was issued last week by the Borough Accountant (Mr. G. A. Thorpe). We learn from it that the revenue from the gas-works amounted to £197,207; and the expenditure (including interest and sinking fund) was £191,051—leaving a net profit for the year of £6156. Up to last year the electric light undertaking had not paid its way; but it has now turned the scale, and shows a profit for the year, after paying interest and sinking fund, of £1385, which leaves a balance to the debit of net revenue at March 31 of £354. It should, however, be noted that out of past contributions to sinking fund from revenue, a sum of £400 has been paid towards redemption of debt; while a further sum of £1870 remains available for a like purpose—making an excess of assets over liabilities of £1916. The revenue account of the Water Department shows receipts for water-rents amounting to £114,315, and from other sources £3955—together £118,270. The total payments were £122,581; making, after reckoning outstanding items, a loss of rather more than £5000.

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* One cubic foot of carbonic acid gas at normal temperature and pressure weighs 817 grains. If 817 grains equal 1 cubic foot, what do 1220 grains equal?—*Ans.*, 1·494 cubic feet.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Bickerton, H. N., of Ashton-under-Lyne. No. 17,342; Oct. 12, 1891.

This prepayment meter for gas or other fluid is shown in side elevation (partly in section) in fig. 1—a portion of the casing being removed; fig. 2 shows a front elevation, with the door removed; and fig. 3, an elevation of the interior face of a door applicable thereto.

Fig. 1.

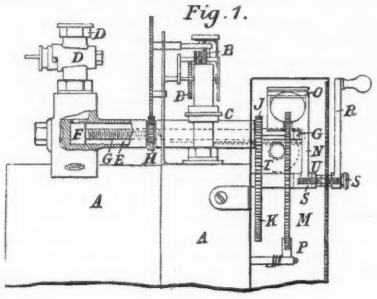


Fig. 2.

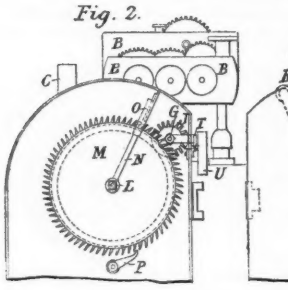
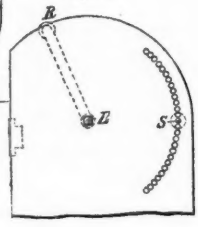


Fig. 3.



A is a portion of the casing of an ordinary gas-meter; B, the ordinary index mechanism; C, the inlet-pipe; and D, the outlet-pipe. The slide-valve—which in this case consists of a plug or plunger F, sliding in the cylinder E—controls the outlet-pipe from the meter. The plunger is attached to the end of the threaded spindle G, which takes into the nut H. This nut is formed as a toothed pinion wheel, engaging toothed wheels, so as to be brought into continuous connection with the ordinary measuring apparatus of the meter. The pinion nut H, being in the recess formed for the purpose in the valve-tube E, is prevented from taking any lateral motion when revolved by the measuring apparatus. Hence the screwed spindle is caused to slide along the tube towards the outlet-valve port by the action of the nut revolving, and so tends to close the valve. The other end of the spindle is formed with a square in cross section, or any other shape which will permit of it passing freely through a second nut, and yet so that this second nut or pinion will turn the spindle during its revolution. This second nut or pinion, as at J, is prevented from moving along the spindle, and engages the toothed wheel K mounted on the shaft or spindle L, rigidly connected with the ratchet or similar toothed wheel M. Mounted upon the spindle L is the lever or arm N, which carries, or is formed with, the coin-holder O at its outer end. This pocket, being open or partially open at the bottom, allows the coin to project through it, and to engage in one of the recesses of the ratchet or other teeth on the wheel, in such manner that, when the lever is moved, the wheel is moved therewith. A pawl P permits this motion in one direction only. The spindle passing through the door may have attached thereto a lever handle R, to enable the operation to be effected from the outside; but a projection from the lever arm may pass through a curved slot for this object. S is a stop for the purpose of measuring the extent of throw of the lever arm; and it is made capable of variation by the position at which it is fixed to the door. To this end a number of small holes may be arranged in a curve as shown; or some other convenient mode of variable stop may be employed—such as by allowing the handle portion of the lever to project through a slot in the door, and a sliding cover with a moveable stop may be in that case provided for the slot. The rack T connected with the end of the spindle G actuates an index-wheel U, for showing the amount of gas at any time unused which has been prepaid. But in case a sliding cover is employed, this index-wheel is dispensed with; and, in lieu of it, an index marked on the cover or along the edge of the curved slot is found most convenient.

The apparatus acts as follows: A coin is passed through the slot in the casing, immediately over the pocket O on the lever N. This pocket, having no front or means for confining the coin, excepting the cross-bar at the upper portion, only retains the coin in its forward travel by the assistance of the toothed disc engaging with the coin's lower edge. On the coin engaging in one of the recesses of the teeth on the disc or wheel M, the operator turns the lever handle R towards the stop S (which has previously been adjusted, and the door closed and sealed, by the proper authority), when the lever handle may be carried back to the slot. This releases the coin from the pocket, and allows it to fall within the casing; and the operation is repeated with other coins, either on the same or a subsequent occasion. The turning of this disc or wheel actuates the pinion nut J, which thus draws forward the screwed spindle G with its plug or piston F, and uncovers the outlet-valve port; thereby allowing the delivery of gas to the burners of the fittings to be supplied. As soon as this is commenced to be used, the ordinary measuring mechanism B begins to revolve; and, being geared to the pinion nut H, it is caused to turn, and thus draws back the screwed spindle G, and with it the plug F until it again covers the port. The amount of gas which can be prepaid on one occasion depends on the length of the spindle, and is a matter of convenience or advisability.

Ammoniacal Liquor Still.—Wright, J., of Stockton-on-Tees. No. 18,533; Oct. 28, 1891.

This invention relates to columnar or vertical stills, in which ammoniacal or other liquors or vapours are treated for the evolution of gases and volatile products in thin layers by means of a current of steam, while the liquids move down the succession of trays, plates, and cylinders of which the still is constructed.

Instead of making the upward current of steam and gas pass through one central opening in each tray (as in stills hitherto constructed), the patentee divides it into two, or any greater number of sections, by arranging the openings through the trays in places proportional to the internal area of the still. The interior caps covering the steam and gas openings have hitherto been made of many forms, from under which the vapours and gases discharged on the outside periphery only. According to the present invention, these caps are made of various annular forms, so as to have their discharging surfaces for the gas under the interior bottom serrated edges or periphery, as well as on the exterior periphery, thereby (according to the patentee) greatly increasing the effective contact-surface of the steam and gases with the liquor upon the various trays. He also makes the caps in some cases of two or more annular rings on each tray; each discharging gases from both the interior and exterior edges or surfaces or peripheries.

Fig. 1.

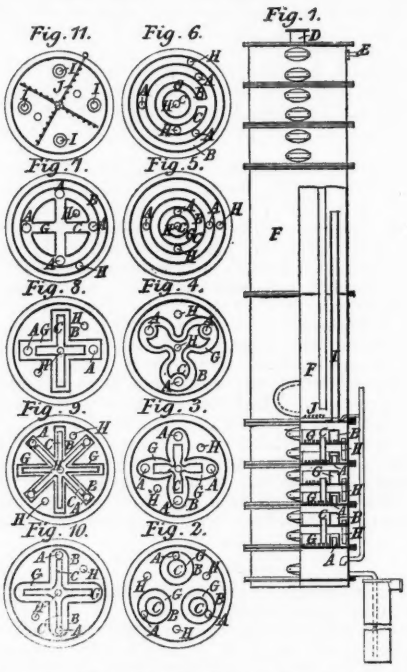


Fig. 11.

Fig. 6.

Fig. 7.

Fig. 5.

Fig. 8.

Fig. 4.

Fig. 9.

Fig. 3.

Fig. 10.

Fig. 2.

Fig. 1 is an elevation (partly in section) of the still itself. It is constructed of a series of vertical shallow cylindrical vessels, of any height, number, or form, having at the top an outlet-pipe D for the egress of the volatilized product, to convey it to the apparatus for fixing by sulphuric acid, and an inlet E for the hot liquor. F is the lime chamber, fixed about the centre of the height of the still. G are the annular (not necessarily circular) caps placed on the trays and plates over the various passages A, for the ascending current of hot gas and steam. They are so constructed as to have discharging surfaces or edges both on the exterior and interior peripheries. The caps are placed on ledges, trays, or plates, about 6 inches apart, so arranged that two of them are provided for in each cylindrical casting, and made accessible for cleaning by small doors at equidistant points round the circumference. The figures Nos. 2 to 10 show a few of the many shapes (in plan) it is possible to make these caps; the exterior edges or peripheries being denoted by B, and the interior by C. The discharging edges in the caps are in all cases serrated or notched to within a proper distance from the overflow-level of the liquor under treatment. The overflow and dipping pipes H are arranged in suitable numbers on each tray to the work required, both inside and outside the serrated edges of the caps above referred to. I are the pipes conveying the gases through the liming chamber; while J is the steam-distributing pipe at the bottom of the lime chamber. K are the liquor overflow-pipes from one of the upper into the lime chamber. The spent-water pipe at the bottom of fig. 1 is sealed by discharging into a well casting of the requisite depth to give the pressure required.

The operation with respect to the flow of the liquor, steam, and gases may be thus shortly described: The steam enters the still in the usual way at the lower part, and ascends from tray to tray by the passages A. It gathers in the interior of the annular caps G; and escaping forces its way by the interior and exterior peripheries into the surrounding spaces, and so on successively until it reaches the lime chamber, through which it is conveyed by the pipes I heating the lime and the water as it passes through. From thence it is carried in a similar way over the upper trays to the outlet D, meeting on the top tier or tray the boiling hot liquor at the inlet E, which in its turn descends by means of the overflow-pipes from tray to tray until what remains of it finally reaches the outlet-pipe, and seals the pot at the bottom.

Gas-Engines.—Barron, A., of Leicester. No. 19,318; Nov. 9, 1891.

This invention relates to gas-engines (either horizontal or vertical, single or double cylinder) constructed with a slide-valve for igniting the gas-flame. Its main objects are to convert the old-fashioned slide-engine into a tube-ignition engine, for the purpose of saving power with a smaller consumption of gas; to obviate the explosion taking place prematurely, besides reducing friction and saving the cost of having to reface the slide; and to cause the ignition or firing to take place at the right time—not before the crank comes to the centre in its revolution.

In lieu of the slide and its case or holder, the patentee arranges, in a suitable box or ignition chamber, a spring-pressed rod, the inner end of which carries a mushroom valve, or its equivalent, which shuts off communication with the gas-valve and air-vessel. The valve is closed before firing takes place by a cam on the side shaft, or a shaft parallel to the cylinder; and it is opened again after firing by the cam contracting the spring on the rod, and so admitting air and gas into the cylinder. A sufficient quantity having been admitted, the valve is again closed; the gas or ignition valve is then opened by the aid of another cam on the side shaft; and this shaft receiving its motion as usual from the crank-shaft of the engine, the explosion or ignition takes place by the following arrangement: A sliding piston-rod or tube, in which is drilled a right-angled slot or hole, is fitted parallel to the other valve before mentioned, either horizontally or vertically, or a mushroom valve or valves may be put upon the rod instead. Whichever is employed, a sliding motion is imparted thereto by pressure of a suitably-shaped cam on the side shaft, when the valve will open under the ignition chamber of the hot pipe, and cause the explosion or ignition to take place upon the crank coming to the centre—thus ensuring the firing occurring at the proper time. To the opposite end of this sliding rod, bar, or tube is secured a spring to keep the other end in contact with the periphery of the cam. Each of the valves is moved alternately at every second stroke of the piston-rod and crank, by the cams on the side shaft; so that, until the firing of the hot pipe has taken place, the one communicating with the air and gas chamber leading to the cylinder is closed, and *vice versâ*.

Washing, Scrubbing, and Purifying Gas.—Chandler, J. C., of Brixton Road, S.W. No. 7708; April 23, 1892.

This invention relates to apparatus for washing, purifying, and scrubbing gas, provided with a series of compartments, in each of which is arranged a perforated plate or plates provided with depending tubes dipping with their lower ends into the water in the bottom of the compartment, and so arranged that, as the gas passes through one compartment to the other, it will be caused to flow down through the tubes into contact with the water.

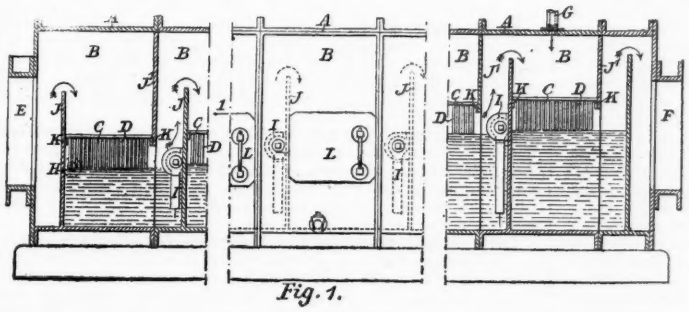


Fig. 1.

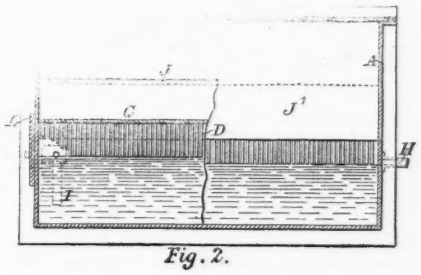


Fig. 2.

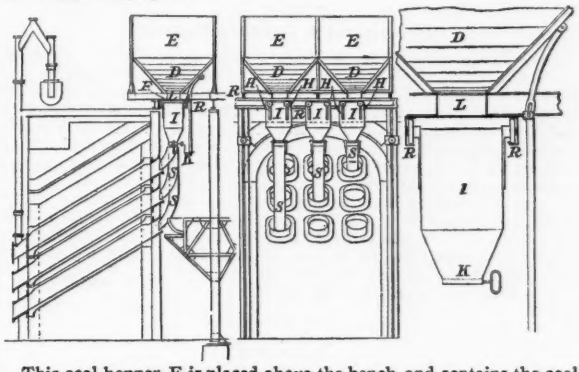
Fig. 1 is a sectional elevation of the apparatus; and fig. 2, a vertical transverse section looking in the direction of the arrow marked 1 in fig. 1.

A is the outer casing or shell of the apparatus, which is divided into a series of compartments B; and C are perforated plates supported in the several compartments, and carrying the tubes D. E F are the gas inlet and outlet respectively, and G H are the water inlet and outlet respectively. I are the overflow-pipes for conveying the water or liquor from one compartment to the other. When, remarks the patentee, several compartments are arranged side by side, the bays are formed by division-plates; those marked J extending upwards from the bottom of the casing, and those marked J^1 downwards from the top. The perforated plates C (which are rectangular, and have the tubes D depending therefrom), are supported between the plates on ledges K, in such a manner that they can slide, so that when the manhole covers L, with which the several compartments are provided, are removed, the perforated plates with their tubes can be drawn bodily out of the apparatus for cleaning or repairs. The overflow-pipes I, which are provided with regulating-cocks, are attached to the plates J J^1, and are arranged in such positions that the water-level is lowest in the chamber B adjacent to the inlet E, and highest in the chamber B adjacent to the outlet F.

The operation of the apparatus is as follows: The unpurified gas enters through the inlet opening E into the adjacent chamber B, over the top of the division-plate J, and thence passes down through the tubes D and through the water into which the bottom of the tubes dip, and thence under the division-plate J^1 into the next adjacent compartment. From this compartment, the gas passes downwards through the tubes D therein and into the next compartment; and so on, from one compartment to the other, until it escapes over the last division-plate to the outlet F. The washing water enters the chamber B, adjacent to the outlet F, and containing the purest gas. Thence it overflows through the pipe I into the adjacent chamber B, thence to the next chamber, and so on through all the chambers. It finally escapes through the outlet E; so that the unwashed gas first meets with the dirtiest water, and in passing the tubes in the last chamber comes into contact with comparatively clean water.

Charging Inclined Retorts.—Drory, E., of Vienna. No. 21,249; Dec. 5, 1891.

The illustration shows a front and side view of a bench of retorts fitted with this patented arrangement, and an enlarged view of the coal-hopper employed.



This coal-hopper E is placed above the bench, and contains the coal required for charging the retorts—broken up and lifted by suitable machinery. The bottom D of the coal-hopper has one or more openings L, which can be closed, when desired, by a slide F by means of a long lever. A smaller moveable hopper I (of any suitable form, and of sufficient capacity to contain the entire charge for one retort) runs on wheels H upon rails R beneath the main coal-hoppers E. This moveable hopper has also an opening at the bottom, smaller than that of the mouthpiece, which can be shut by a slide. When a retort is to be charged, the workman pushes the moveable hopper I under the opening L of the coal-hopper E, opens the slide F by means of the lever, whereupon the coal fills the moveable hopper I, of which the bottom slide K is closed. When the moveable hopper is full, the workman closes the top slide F, pushes the moveable hopper I over the retort to be charged, puts the shoot S into the mouthpiece, opens the bottom slide K, and allows the coal to fall into the retort, thus completing the charge.

The claims for this invention are for— (1) An arrangement for filling inclined retorts used in the manufacture of coal gas and for similar purposes, by which the coal or other material to be charged into a retort or other receptacle, is permitted to fall, by means of the slide F of the hopper E, through the opening L of the coal-hopper E into the moveable hopper I. (2) The moveable hopper I, for containing the complete charge for a retort or other receptacle, suspended on wheels and adapted to be pushed in the required direction along the overhead rails and be discharged by opening the slide K.

Gas-Lamp Burners.—Trendel, F., of Berlin. No. 14,714; Aug. 15, 1892.

Alluding to his proposal, the patentee says: In burners as heretofore employed for gas-lamps of the kind in which an outward burning flame is supplied with air both from above and from below (regenerative gas-lamps), the great disadvantage is experienced that the small openings of the burner through which the gas issues become clogged with deposit from the flame, or such deposit takes place round the openings, whereby the flame is made to burn unequally, and cause inefficient illumination. The present invention has for its object to obviate this defect; and it consists in so constructing such burners that, at a point above that where the outlet openings for the gas are situated, the burner is of a larger diameter than at the point where the openings are. By this means, the air-currents flowing downward from above are prevented from coming in contact with the part of the burner where the holes are situated, being deflected away by the larger upper diameter of the burner, so that the mixing of the air with the gas (and the consequent combustion thereof) is made to take place at a certain distance away from the burner holes, instead of at the holes themselves. According to a modification of this arrangement, the part of the burner below the holes is also made of larger diameter than at that part, so that the air supply from below is also deflected.

APPLICATIONS FOR LETTERS PATENT.

18,012.—Coe, C. H., "Water-taps." Oct. 10.

18,020.—Southall, J., "Gas and oil motor engines." Oct. 10.

18,047.—Henderson, N. M., M'Arthur, J. S., and Hunt, E., "Destructive distillation of oil-yielding or gas-yielding minerals, and obtaining products therefrom." Oct. 10.

18,056.—Taylor, D., "Combination gas-stove and cooking-range." Oct. 10.

18,109.—Southall, J., "Gas and oil motor engines." Oct. 11

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Regenerative v. Ordinary Settings.

SIR,—In answer to Mr. D. Irving's letter in the JOURNAL for the 11th inst., the calculation referred to is made by multiplying the number of bushels of coke used by 100, and dividing the result by the number of bushels made. The quantity of coal carbonized in 1891 was 2084 tons of Newcastle (Pelton Main), including 71 tons of cannel; the coke produced being 2192 chaldrons, of which 1899 chaldrons 34 bushels were sold. Replying to H. L., whose letter appears in the same issue, I may say my time is too much taken up just now to give a paper at one of the Associations; but later on I may do so. In the meantime, I shall be pleased to explain what we are doing here, if anyone thinks it worth while to call, or to correspond with me. I, with others, should be glad to know what coal H. L. is using, to make 8000 cubic feet of gas per mouthpiece.

W. J. LATCHFORD.

Broadstairs Gas-Works, Oct. 17, 1892.

Anthracene.

SIR,—Many of your readers will doubtless think it presumptuous on my part to offer an opinion, or tender any advice, upon the subject of anthracene; but it is not my intention to express an opinion, or offer any advice, upon it, but merely to repeat a remark made to me about it some three or four years ago. A gentleman whom I thought at the time was well qualified to express an opinion, said: "All the dyes made from anthracene injure the fabric to some extent, more or less, and, although they are all the rage now, they will nevertheless, when the large stocks which the manufacturers have now on hand are used up, get out of favour." I have no authority for this statement beyond what I have here said; but whether it be true or not, it is much to be regretted that so large and important an interest as it has now become should have but one outlet.

The Board of Trade Returns for 1890 (the last issued) give the quantity of coals used for gas-making purposes in one year as: Companies, 6,618,400 tons; corporations, 3,623,917 tons—total, 10,242,317 tons. But as this only applies to authorized companies, and as there are still a large number of others, it is probable that, if these were added to the above total, it would reach 11,000,000 tons. Now, as every ton of coal used for gas-making purposes yields in the process of distillation something like 10 gallons of tar, the quantity produced annually is close upon *one hundred and twenty million gallons*, whether it is wanted or not; and the same returns show that the quantity has for the last ten years been increasing at the rate of more than a million gallons every year.

Any reference to tar brings to my recollection an incident connected with it that occurred to myself many years ago, but which it may not be out of place to mention here. It happened at the time asphalte pavements, which were expected to supersede everything else used for those purposes, were just coming into favour. I wanted, for some object of my own, a small quantity of boiled tar; and, knowing that I should not be allowed to prepare it myself, if observed, I used my own bedroom for the purpose. The house was a very old one, and the hearthstone in front of the fireplace in my bedroom had sunk about an inch below the flooring—a fact which, in all probability, saved both myself and the premises from total destruction. Before commencing operations, I locked the door and opened the window; and then putting the tar into one of those iron bottles much used at the time, I placed it on the fire. It soon boiled up. Then, wanting to remove it, I found that I had not made any arrangements for the purpose; so I took the only thing available—a pair of tongs—when, as I might have expected, the bottle overbalanced itself, and the tar fell into the fire. In less time than I can describe, the grate, hobs, fire-irons, hearthstone, and everything else that the fire could reach, was in a blaze with a dark lurid flame; but the tar, being stopped by the hearthstone, did not get on to the flooring. I tore up a piece of the carpet, soaked it in the slop-pail, and then held it over the burning tar—thinking to extinguish the fire in that way. But, immediately on the water reaching the tar, the dark lurid flame changed into a bright luminous light quite equal to the gas then supplied; this coming up to my knees. I let the carpet drop over the tar, rushed to the window, closed it, and holding my mouth over the crevice between the upper and lower parts, kept it there until the fire burnt itself out. On turning round, I found everything in and about the room—bed, bedding, clothes, carpets, walls, and curtains—with my own hair, eyes, nose, and ears, covered with the fumes; nothing but my mouth being clear. How I ultimately got right again, I need not now explain; but, troubled as I was at the moment, I noticed that the application of water to the burning tar immediately brightened the flame.

Ever since then it has occurred to me from time to time that, by some combination of tar and water, some better use for the former might be found; and this opinion has been greatly strengthened by the two or three attempts recently made for the introduction of water gas. In the early days of gas lighting, resins, oils, grease, and other like materials, were employed for making portable gas; and at the present time petroleum is much used for improving the quality. In *Chambers' Journal* for this month there is an article on the origin of petroleum, which indirectly bears upon this question.

If gas engineers, instead of being content with following in the steps of one another, would but import a love of science into their operations, and give their attention to these matters, there can be but little doubt that, by some combination or other of these various substances, greatly improved results would soon be discovered. But the whole subject of the large and continually augmenting quantities of the products must tend to decrease their value, and consequently to increase the cost of making gas.

W. LIVESEY.

Gas Companies' Association, 76, Palace Chambers, Westminster, S.W., Oct. 22, 1892.

Mr. Gadd's Mechanics.

We have received a further letter from Mr. W. Gadd, in the course of which he expresses an opinion (and it is one in which we heartily concur, as will probably the majority of readers who have followed the correspondence recently published with the above heading) that "there appears to be no possibility of attempting to get any further with the subject." Consequently, in closing this correspondence, we need only insert two portions of Mr. Gadd's last letter.

The first portion is in relation to the "synopsis" Mr. Milbourne gave of the previous references in our pages to the subject, and Mr. Milbourne's allusions thereto. Concerning this, Mr. Gadd asks: Was I proved to be in error by Mr. Cripps choosing to ignore the fact that my original paper distinctly gave a diagonal in addition to a vertical force as acting upon the holder, when he so unfairly assumed the vertical force given to be the sole one intended? Again, was I proved to be in error over the wretched *plus* and *minus* business, which the same gentleman at the first placed in the forefront of the battle? Further, was I proved to be in error when even my illustrations had unwarranted and really absurd additions and alterations made to them, to enable false and even ridiculous meanings to be attached to them?

Further on in his letter, Mr. Gadd says: I take my stand with the highest authorities on the point yet remaining in dispute, and preach no new mechanical doctrine. I may have been able to put old ideas in a new light, and that is all. Hence the very heading to this correspondence is misleading. I hope, ere long, to be prepared with a physical experiment which will actually point out and demonstrate, under the exact conditions in practice, the precise spot where the centre of pressure, applied over the points as defined, will fall. Mr. Milbourne may then, if he likes, say that Nature does not know her own business.

The Electric Lighting Question at Wigan.—At a meeting of the Gas Committee of the Wigan Corporation held last Wednesday, it was decided that application should be made to Parliament for power to borrow £50,000 for electric lighting purposes.

Electric Lighting at Prescot and Knowsley.—An installation for the illumination of Prescot and Knowsley Hall by electricity has been completed. It is proposed to place twelve arc lamps, each of 2000-candle power, in prominent positions in the town; and these are to be supplemented when required by incandescent lamps.

A New Lancashire Coal-Field.—At a meeting of the Heywood Town Council held last week, it was reported that an extensive bed of coal has been discovered on the Gristlehurst Estate, belonging to the Corporation. Offers have been made to purchase it; but the Town Council have decided to bore for the coal themselves, and ascertain its real value before selling it.

Matlock Bath Water Supply.—The Local Government Board have sanctioned a loan of £1300 for a new reservoir, together with the acquisition of a spring, for the extension of the water supply to Matlock Bath. The Local Board have ordered tenders to be obtained for the works. The Engineer of the scheme is Mr. W. H. Radford, of Nottingham.

The Assessment of the Brighton Corporation Water-Works.—The Water Committee of the Brighton Town Council have given the Town Clerk instructions to appeal against the assessment of the new pumping-station at Patcham, which has been placed at a gross estimated rental of £5000 and a rateable value of £3501, in substitution for £75 gross, and £70 rateable.

Carburetting Plant for the Wilmslow Gas-Works.—Messrs. R. and J. Dempster are at present constructing for the Fourness Gas Process Company, Limited, plant for the manufacture of carburetted water gas under the patent of Mr. H. Fourness, some particulars in regard to which have already appeared in the JOURNAL. The plant is to be erected at the works of the Wilmslow Gas Company, under the supervision of Mr. J. Mackenzie, their Engineer and Manager.

Gas Explosion in a School-Room.—An explosion of gas occurred last Sunday week at the Wesleyan Sunday School at Brierfield, near Nelson, Lancashire. By some means the tap of a gas-stove in the class-room had been opened; and, when the caretaker entered the room with a light, an explosion occurred. The stove was blown to pieces, many windows were forced out of the building, and serious damage was done to the premises; but fortunately, no one was injured.

The New Gas-Works at Colne.—An official inspection of the new gas-works at Colne was made by the members of the Local Board last Wednesday. Of the £22,000 borrowed for the works, £18,000 has already been spent; and it is probable that an extension of the borrowing powers will be required before the works are completed. The producing capacity of the plant at present is 725,000 cubic feet per day, or 180,000 cubic feet in excess of the heaviest day's consumption last winter.

Welsh Local Authorities and the Metropolitan Water Supply Question.—In consequence of proposals having been made to obtain an additional supply of water for London from Wales, representatives of the Local Authorities in Glamorganshire, Monmouthshire, and Carmarthenshire have agreed, at a conference held at Cardiff (Sir Hussey Vivian, M.P., presiding) to take immediate steps, through the County Councils, to secure united action, in order to conserve the high-level areas in these three counties for the water supplies of the inhabitants of the district.

Bursting of a Reservoir.—A new reservoir, which Lord Masham has constructed on the upper course of the Solbeck at Ilton, burst during the heavy rain of last Friday week, and did considerable damage. Huge stones three or four tons in weight were heaved from their places and rolled down the stream by the rushing water. All the bridges over the Solbeck were broken; every vestige being swept away with five or six yards of the approaches on either side. There is a deep gap in the reservoir dam from 20 to 30 feet across, through which the water rushed. The dam has shown signs of leakage before, and has been repaired and strengthened several times this summer. The reservoir was built to supply the motive power for the new electric lighting machinery at Swinton, and was about 10 acres in extent

MISCELLANEOUS NEWS.

THE PRICE OF GAS QUESTION AT PRESTON.

Our readers will have seen, by the paragraph which appeared last week, that Preston has held its "indignation meeting," and has expressed, with all the vigour at its command, its opinion on the policy of the Gas Company. Whether or not the result will be to induce the Company to reconsider their decision as to the price of gas, remains to be seen. The probability is, however, that the notices of the advance will not be withdrawn. The Company have wisely issued a full statement of their case, ably drawn up by Mr. H. Green, their Engineer and Secretary, the principle portions of which are given below. With this before one, it is easy to test the value of the arguments so glibly advanced against the Company. Two points were especially emphasized at the meeting. One was that gas is dearer in Preston than in other towns; the other, that the capital expenditure has been needlessly heavy, and the amount consequently required for the dividend is in excess of that of other places. Mr. Alderman Walmsley, who has taken the lead in this agitation, adduced an array of figures in support of these contentions. "The average net price of gas in about 40 towns, the majority of which were smaller than Preston, was" he said, "2s. 6d. per 1000 cubic feet; while the lowest price Preston had ever charged had been 2s. 9d." Every gas manager is familiar with this kind of argument. It is brought forward in every case in which it is thought desirable to attack the interests of a gas company; and it will probably continue to be used so long as there are interests to attack and unthinking people to applaud. Mr. Green, however, fully disposes of it in his statement. Selecting 106 of the largest gas undertakings in England, he points out that 33, or nearly 30 per cent., of them have been compelled to advance the price of gas during the last two years; while the price at Preston is lower than at 55 of the 106 towns. Nor is this all. Mr. Alderman Walmsley, with his carefully selected list of "about 40 towns," had not the slightest difficulty in making out a plausible case against the Preston Company. It is needless to say that he did not acquaint his audience with the fact that the Company is under statutory obligation to supply gas of an unusually high standard. The minimum illuminating power is 18 candles; and, as Mr. Green points out, this has so important a bearing on the cost of fuel, that, if a reduction to 16 candles were possible, an advance in the price of gas would be scarcely necessary. As it is, the Preston Company are supplying gas at a lower rate than 15 out of 29 neighbouring towns, most of which have a lower standard of illuminating power; and even after the advance, the then price will be less than that of nine of these towns. Having regard to the quality of the gas, this is a state of things of which the Company has no need to be ashamed. The statement as to the reckless expenditure of capital and the high dividends paid is equally misleading. The original capital of the Company was £120,000, with a maximum dividend of 10 per cent. Seeing that the Company is one of the strongest in the kingdom, and was established when the future of gas lighting was by no means assured, this rate of profit can hardly be considered excessive. In later years, but still before the days of auction clauses and sliding scale, a further sum of £120,000 was authorized to be raised at 7 per cent.; and a third issue of capital was sanctioned in 1881, with auction-clause conditions. Mr. Alderman Walmsley complains that these conditions were not attached to the second issue; and he spends time in vain regrets that Parliament did not put in force in 1862 a device which was not invented until many years afterwards. A sufficient reply to twaddle of this kind, which is meant only for the ears of those who are too prejudiced or too ignorant to consider the question for themselves, is to be found in the fact that the Company has raised all its recent capital at an average of 4½ per cent., and has almost entirely foregone its legal right to set aside a reserve fund of £36,000. Mr. Green puts down the number of original shareholders who are still receiving 10 per cent. on their investment in the Company at a dozen or less. On the other hand, there are, out of 499 shareholders, 174 ladies and 120 trustees, who have invested in the stock no doubt in the belief that the rate of interest on the purchase money would be maintained. It would be interesting to know what Mr. Alderman Walmsley and those who support him would do with these people.

We pass over much more that is interesting, alike in the speeches at the "indignation meeting" and in Mr. Green's report, to make a few remarks as to the causes of the present increase of price. These are classed by the Company under four heads: (1) Increase in the cost of coal and cannel; (2) extra pay for labour; (3) advance in rates; and (4) decrease in receipts from residuals. The advance in the rates is a purely local matter; and all that need be said of it is that municipal extravagance or the needs of the town (Mr. Alderman Walmsley may take his choice) have in the past six years caused an addition of 1s. 9d. in the pound in the amount of the rates levied in Preston. As to the drop in the value of residuals, this is unfortunately indisputable and irremediable. From the remaining causes of the increased cost of manufacturing gas, the Preston Trades Council, which is largely responsible for the present agitation against the Gas Company, may learn that valuable lesson familiar to Lancashire men in the saying that "one cannot eat his cake and have it too." The Trades Council represents in a collective form the Trades Unionism of the district. To this is due, as its supporters are not slow to remind us, the agitations which have led to advances of wages and a general disturbance of the labour market. The gas stokers' labourers at Preston are getting £1400 a year more than they received formerly; and the colliers are receiving a proportion of the £6000 which represents the extra annual cost of the coal and cannel used in making gas. If the cotton operatives of the town have to pay a little more for the gas which lights their cottages than they have been accustomed to pay, they will surely find comfort in the fact that their fellow-unionists are reaping the benefit. It may be hard on them individually; but what good unionist would not sacrifice himself to benefit his neighbour?

The Case for the Gas Company.

The following are the principal portions of the statement prepared for the Directors of the Preston Gas Company by their Engineer and Manager (Mr. H. Green), referred to above:—

The primary causes which have led you to make the advance are: The great increase during the last few years in the cost of fuel and labour, and in rates, and the decrease in the value of residual products. The price of fuel advanced during the last two years 2s. 8½d. per ton; causing an increase in the Company's expenditure of £6114 a year. There will be a slight improvement in this account, amounting to £1100 a year, as contracts for gas coal have been made for the coming twelve months at rather lower rates. The cost of labour has increased about £1400 a year; and rates, £1850 a year. Residual products have decreased very seriously in value. The last few years sulphate of ammonia has gone down about £2 10s. per ton; causing a loss of £1250 a year. Tar during the last few months has dropped £1 per ton; causing a further loss of about £3000 a year. These items adversely affect the Company's accounts to the extent of £13,600 a year. The increase in the price of gas which you have decided upon will produce only £7667; still leaving a yearly adverse difference of £5933. I would point out that the serious advances in the cost of labour and coal (the latter being largely due to the labour question) amount together to £7500 a year—a sum equal to that realized by the advance in the price of gas. I may also mention that the advance in rates does not wholly result from the augmented assessment, but that £1000 a year arises from the increased rates over those of 1885, these having risen 1s. 9d. in the pound since that date.

From the information obtained relative to 106 of the largest gas undertakings in England, I find that 33, or nearly 30 per cent., have during the last two years been compelled to increase their charges for gas to the extent of from 2d. to 5d. per 1000 cubic feet; some having to advance their prices twice during that period, 29 of the 33 having advanced their prices prior to the serious decline which has taken place in the value of tar. There seem to be many erroneous impressions in the minds of some of your consumers, more especially of the cottage consumers, as to the effect of the advance you are making in the price. I would therefore direct attention to the fact that the average consumption of gas per head of consumers (exclusive of the public lamps, but including mills, railway, &c.) is in your district less than 18,000 cubic feet per annum. The increase of 4½d. per 1000 cubic feet will therefore amount to an average of 6s. 3¾d. per consumer. Many of the cottagers, however, consume only from 5000 to 8000 cubic feet of gas per annum. The effect on them will be to increase their payment for gas by 2s. to 3s. a year, or from ¼d. to ¾d. per consumer per week.

Comparing your present net prices with those of 106 of the largest towns in England, I find that out of 29 neighbouring towns your price is lower than 15; and out of the 106 you are lower than 55. After the increase in your price, you will, as compared with those 106 towns, still stand lower than nine of the neighbouring towns, and than 24 towns throughout England. Besides these, there are 10 other towns whose price is 3s. per 1000 cubic feet, or only 1d. per 1000 feet less than your increased price. The comparison of prices is also materially affected in favour of Preston by the illuminating power of gas prescribed, as afterwards explained. This position would further have been improved if your charges for the out-townships were, as in many towns, especially in Lancashire, 6d. to 1s. per 1000 cubic feet in excess of Preston. But in your case 75 per cent. of the out-township consumption is at the Preston price—the balance of 25 per cent. being charged the small extra sum of 2½d. per 1000 cubic feet net.

An impression exists in some quarters that the power to increase your price is unlimited. Such, however, as you know, is not the case. The maximum prices allowed by your Act of Parliament are 4s. 2d. per 1000 cubic feet for Preston and Fulwood, and 4s. 7d. or 5s. for your out-townships (Fulwood excepted); all being subject to 10, 15, or 20 per cent. discount, according to amount of consumption. Some years ago, with the view of encouraging cottage consumption, the 10 per cent. discount was increased to 15 per cent.; placing the cottage consumers upon an equality with those burning up to 2 million cubic feet of gas per annum.

In considering the question of price, it is most important that the quality of gas should also be taken into account. There are 542 gas undertakings in England under statutory powers. Of these, 26 have no prescribed standard; and 10 to 13½ candles are the minimum standards of 23 places. The minimum standard of 327 is 14 candles; of 114, 15 candles; of 41, 16 candles; of 1, 17 candles; of 8, 18 candles; and of 2, 20 candles. Preston is one of the eight having a minimum standard of 18 candles. It will, therefore, be seen that Preston has a higher standard than 98 per cent. of the gas undertakings in England.

These standards of quality materially affect the cost of the production of gas; as the higher the standard required, the more expensive is the class of fuel needed to produce it. This is clearly demonstrated in the returns I have obtained. Out of 16 neighbouring towns from which I have been able to ascertain the cost of fuel per ton, there are only two (Liverpool and Southport) where the cost exceeds yours, and these are the two towns tied to a minimum of 20 candles. The remaining towns obtain their fuel at prices ranging from 6d. to 4s. per ton less than Preston; and this difference in price may reasonably be attributed to the higher standard of quality Preston has to maintain. If the standard of the Company were fixed at 16 candles or less, as 98 per cent. of the gas undertakings are, the cost of manufacture would be reduced by £6500 a year. The Company would thus be enabled to a great extent to maintain the present price of gas. It will thus be seen that the quality of the gas this Company is compelled to give entails an extra cost for its manufacture of nearly 4d. per 1000 cubic feet. [Mr. Green cited the recent action of The Gaslight and Coke Company in abandoning the supply of cannel gas, to show that, even with an addition of 9d. per 1000 cubic feet, it does not pay to give a supply of 20 instead of 16 candle gas.]

On the part of some of the Company's consumers, there appears a desire that the meter-rents should be abolished. This course has been adopted by certain towns, and in some cases without much injustice being felt by any special class of consumers. But such would not be the case in a town having, as in Preston, the extremes of consumption, such as cottage and mill consumption; for if the Company give

up the meter-rents, the income arising from them (which is equal to 2d. per 1000 cubic feet) would of necessity have to this extent to be obtained by an increase in the price of gas. A small consumer, of whom there are hundreds, burning (say) 5000 to 6000 cubic feet of gas per annum, would be benefited to the extent of 1s. 6d. a year—this being the difference between the meter-rent abolished (2s. 6d.) and the extra amount (1s.) paid for his gas; the difference (1s. 6d.) having to be made up by the larger consumers, and by the small shopkeepers, dressmakers, and shoemakers living in cottages, who are necessarily much larger consumers than the ordinary cottager. The abolition of meter-rents would, therefore, be greatly to the disadvantage of the larger consumers.

Many erroneous statements get abroad with reference to the question of the Company's capital. We are compelled by law to afford an adequate supply of gas, and to meet all increasing demands. To do this, extensions of works are from time to time necessary; but, as you are aware, they have never been carried out until they have become unavoidable. There is no reason why capital should be extravagantly wasted on unnecessary extensions. It is to the interest of no one to do this. Any stock raised under the Act of 1879 is, by law, compelled to be offered for public competition, by auction or tender. It has, in fact, always been sold by auction. The purchaser does not obtain 7 per cent. on his purchase-money; he obtains really less than 5 per cent. The purchaser receives 7 per cent. on each £100 of stock which he purchases; but for this he has hitherto paid from £140 to £163, according to the market price. The dividend he receives on his purchase-money averages about 4⅜ per cent. The premium, or payment over £100, carries no dividend. Again, the Company, for each £100 received from the sale of stock, exercise their power of borrowing £25, which at present they can do at 3¼ per cent. Thus, for all the capital now raised by the Company, not more than an average of 4½ per cent. is paid by them or received by the holder. The exercise of the borrowing power is a benefit to the gas consumer; and the Company have never issued stock until after their power to raise loans had been exercised. As before stated, it is to the especial interest of no one to issue capital, as it must be offered for open competition, when anyone is at liberty to buy—no preference being given to, or claimable by, existing shareholders. It would be absurd to say that even prior to 1879 money was squandered for the express purpose of creating 10 and 7 per cent. capital; and it is still more absurd to say, as was ignorantly stated at the Town Council meeting held on the 25th of August last, that "there was a terrible and furious struggle amongst the Directors themselves as to who should lend that money at seven per cent." It would have been unnecessary to have noticed such an absurdity as this, if it had not been stated openly in the Town Council. But such being the case, I may say that all stocks issued previous to the Act of 1879 were, as by law compelled, allotted to the shareholders in proportion to the stock held by them at the time of allotment. Another statement made at the same meeting was that "they looked as if they could not spend enough. A year or two ago somebody got a patent for gas-meters which it was proposed should be put to every street lamp. They had 2394 lamps in Preston, and a meter to every lamp. If that was not a shameful state of things, and an extravagant expenditure of money, he did not know what was." I need not perhaps allude to the cause which determined you to exercise your legal right of having a meter to every lamp. You will no doubt have a distinct remembrance of the great advantage which resulted to the Company, and that the saving in unaccounted-for gas in two years recouped the cost of the meters.

Comparisons have been drawn respecting the amount of capital expended per million cubic feet of gas sold. Such comparisons are, however, not reliable, for there are many circumstances operating against such a comparison. For instance, out of 106 undertakings concerning which I have procured information, Preston stands in the unenviable position of being one of six selling the least quantity of gas per consumer. The consumption (exclusive of public lamps) is, in Preston and the district, 17,800 feet per consumer; whereas the average of 29 towns in the neighbourhood is 28,100 feet, and the average of the 106 towns in England is 44,800 feet per consumer. Again, taking the gas consumed by the public lamps, I find that the annual consumption of the 29 neighbouring towns averages 413,000 cubic feet per 1000 of the inhabitants; and the 106 towns in England average 445,000 cubic feet per 1000. The annual public lamp consumption in Preston amounts only to 158,000 cubic feet per 1000 inhabitants. In this we stand even worse than in the private consumption, inasmuch as we are the lowest but one in all the 106 towns; many of them reaching 500,000, and some being even as high as 1,000,000 cubic feet per 1000 inhabitants, against 158,000 cubic feet in Preston. It will thus be seen that the badly-lighted condition of the streets of Preston arises not from any defect in the quality of the gas, but from the small quantity consumed by the public lamps. These very low consumptions in Preston swell the expenditure of capital very materially per million cubic feet of gas sold; for our mains, service-pipes, and meters are of necessity made capable of passing three or four times the quantity of gas actually conveyed by them. Works must be constructed of a capacity sufficient to meet the greatest consumption during any particular hour; and figures prove that in Preston this heaviest occasional hourly consumption bears an unusually large proportion to the yearly consumption, as compared with other towns both in the neighbourhood and throughout England. In towns where trades of various kinds unrestrained as to the hours of labour are more numerous than in Preston, the mains, services, and meters are fully and profitably employed for longer hours during the day than is the case where, as in Preston, cotton-mills largely predominate. This applies to all parts of the year. It will therefore be evident how impossible it is to make any satisfactory comparison.

An impression seems to prevail that your shareholders are receiving on their investments 10 and 7 per cent. This is not the case. Probably there are not a dozen shareholders now in the Company receiving 10 per cent. on the money invested by them; and this also largely applies to the holders of the 7 per cent. stock issued prior to 1879, for these stocks have frequently changed hands since their allotment. As before stated, the stock authorized by the Act of 1879 has to be sold to the highest bidder by auction or tender, to the advantage of the gas consumer. The premium realized is not entitled to any dividend. The 7 per cent. rate of dividend thus becomes merely a nominal rate; the real rate averaging not more than 4⅝ per cent. It must not be overlooked that the satisfactory premiums obtained for this stock were paid on the assumption that the holders would, by the maintenance of the dividend, continue to obtain the same rate of interest on their purchase-money; and the impression of its security no doubt has induced many ladies and trustees, of whom (out of 499 shareholders) there are 174 of the former and 120 of the latter in the Company, to invest in this stock. It may be asked: What effect would a reduction of the dividend on this stock have upon future sales? No doubt there would be a serious fall in price. The premiums would be largely reduced, and the Company would, in effect, have to pay a higher rate of interest for the capital which they would have to raise. This would directly injure the consumer, as less capital not entitled to dividend would be added to the funds of the Company.

In conclusion, I would point out that the Company are entitled by law to have a reserve fund of £36,000. Instead of this amount, they have a reserve fund of only £4600. This arises from the anxiety of the Company to keep down as long as possible the price of gas.

CARLISLE CORPORATION GAS AND WATER SUPPLY.

The Annual Accounts—Additional Borrowing Powers.

At the last Meeting of the Carlisle Town Council—the MAYOR (Mr. B. Scott) presiding—the Gas and Water Committee submitted their minutes and also their annual report and statement of accounts, which have already been noticed (see *ante*, pp. 390, 652). The minutes contained the following resolution: "That the Council be recommended to make application to the Local Government Board for a Provisional Order, authorizing the borrowing of £25,000, the estimated amount required for gas-works purposes during the next ten years, and that the Town Clerk be instructed to take the necessary steps in the matter."

Mr. J. R. CREIGHTON, in moving the adoption of the minutes and the report and accounts, expressed his regret that the Chairman of the Committee (Mr. Forster) was unable to be prseent through indisposition. As to the accounts, he said they were not so favourable as they had been in past years. Compared with the previous year, they were some £500 or £600 to the bad; but this was largely due to the falling off in the residual products. There was a small increase in the item of wages and in that of maintenance. But they prided themselves that they kept the gas-works in a great state of efficiency; and they did not try to show a profit by at all starving them. He might also say that the cost of maintenance was a trifle under what was generally allowed for first-class works. He believed the cost was supposed to be something like 6d.; but in the case of Carlisle it was a shade over 5d. The falling off in the receipts for residuals was to some extent due to coke; and the Gas Committee were rather surprised that the citizens did not buy coke, especially as it was sold at a price at which it would compete favourably with coal. The price of coal during the year was practically the same as in the year before. In the current year, however, they expected there would be a considerable—at least some—saving in the cost of coal; and though the price of some of the residuals would still fall, they had hopes that in the current year the profits from the works would show a substantial increase. One point he thought they, and especially the Manager (Mr. J. Hepworth), might fairly take credit for; and that was the extremely small quantity of unaccounted-for gas. It was under 2 per cent. Owing to the care that had been taken during the past year, the decrease was no less than 1¼ per cent.; and not only did the gas consumers obtain their gas at a very low price, but the Council also benefited directly in that the price charged for the lighting of the street lamps was £941 less than the cost price. At the present time, the increase of the business of the gas-works was most satisfactory. The quantity of gas sent out was very much larger than the previous year; and there was no doubt, when coals were cheaper and residuals rose, the profits would be what they used to be in the good old times. The Committee had considered whether it was not advisable to raise the price of gas; but they came to the conclusion that they would not do so. In regard to water there was a small increase of something like £100; and the consumption was steadily advancing.

The MAYOR seconded the motion.

Mr. W. PHILLIPS, commenting upon the accounts, said that private gas-works usually paid 10 per cent., whereas the Gas and Water Committee would require to increase the price of gas 50 per cent. before they could pay that amount of interest. He asked whether no economy could be effected with regard to extensions. As to the water-works, he thought the water charges were excessive; and a considerable reduction should be made.

Mr. WHITE remarked that it was very gratifying the Committee had been able to produce such satisfactory results without increasing the price of gas.

Mr. COULTHARD considered the members of the Council should be proud of the result of the operations of the Gas Committee. Had they not lost about £1000 upon coal and the same on tar last year, they would have stood in a much better position to-day.

Mr. CREIGHTON, referring to the contemplated further borrowing powers, said that the £25,000 was principally for new mains. This sum they expected would last them ten years. The only other large expenditure they would have to face was for an additional gas holder; but they did not ask powers for that at present.

The motion was then agreed to.

Bromyard Gas Light and Power Company, Limited.—This Company, which was originally registered in 1856 as the Bromyard Gas Company, Limited, has been re-registered, under the Joint-Stock Companies' Acts, with the above title, by which its objects are sufficiently indicated. The capital is £3000, in £10 shares.

AUSTRALASIAN GAS ASSOCIATION, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, at the London Offices, Clement's House, Clement's Lane, E.C.—Mr. H. L. HAMMACK, J.P., D.L., in the chair.

The SECRETARY (Mr. G. J. Gray) read the notice convening the meeting; and the Directors' report and the accounts for the year ending June 30 last (to which allusion was made in last week's issue) were taken as read.

The CHAIRMAN said he had first to congratulate the shareholders upon the fact that, while many companies were not paying dividends or were declaring reduced dividends, he had to ask them to accept a report in which the Directors proposed the small diminution of 1 per cent. only, which gave them the substantial dividend of 6 per cent. for the year. The Board were a little disappointed with this, because their Australian friends were very sanguine they would be able to support the 7 per cent. paid on former occasions. A good deal of the money they previously employed was borrowed at 4 per cent. But they had now raised a large amount of additional share capital; and the extra 2 per cent. they had to pay on this made a considerable difference to them. With regard to the past year's working, the result showed a profit of £4633. Deducting from this the amount absorbed in paying the interim dividend at the rate of 7 per cent., they had at command a balance of £1684 with which to pay the dividend now recommended at the rate of 5 per cent. This would leave £219 with which to start the current year, the working of which, the Directors hoped, would result in their being again able to recommend the dividend which had been paid hitherto. In the course of the year, they had expended £3527 on capital account. There had been an increased revenue of £674; while the manufacture of gas had cost £141 less. For this increased revenue and reduced expenditure, every credit, he thought, should be given to their representatives in Australia, who had done their work thoroughly well in the desire to promote the best interests of the Company. With regard to the accounts, they would not find anything entered for depreciation. This was the fourth year of the Company's existence; and really no depreciation had taken place, the works being very substantially built. When such things as retorts and mains required replacing, they were paid for out of revenue; and they could not pay for renewals in this way and take an amount for depreciation as well. He might here mention that, owing to the fact that the import duty in Victoria had been increased by 15 per cent.—from 30 to 45—the cost of their plant, if they had now to erect the works, would be largely increased. Of course, by-and-bye, when the works had had a longer life, they would make deductions for depreciation. The report referred to the Charters Towers Gas Company, from which they ought to have received a dividend which would have increased the amount divisible. The Directors of that Company were of opinion that, instead of giving the shareholders a dividend, they should apply the money in the extension of the works. These extended works meant an expansion of business and greater profits, in which the Association would share in the future. They had been somewhat affected by the depression which had been very general in the Australian Colonies. A new Railway Commission had been appointed, and they had curtailed the number of trains; the consequence being a reduction of the amount of gas consumed at the stations supplied by the Association. There had, however, been an outcry against this diminution of the train service; so that it was expected this reduction would only be temporary. The report stated that the Directors had acquired the Northern (Melbourne) Gas Company's property upon favourable terms; and they had every reason to believe the amalgamation would prove most satisfactory. They only entered into possession of the works on the 1st of July last; so that the profits to be derived from them would come into the current year's accounts. There was one other matter he should mention before closing his remarks. They had now arrived at the position when the share capital issued justified the Directors in approaching the Stock Exchanges of London and Melbourne for quotations. They had made arrangements with an eminent firm of brokers to conduct their case before the London Stock Exchange Committee; and if they were successful, it would be very much to the interest of the Company and the shareholders. Having issued the present number of shares, the Directors did not contemplate disposing of any more, except at a premium; so that the shareholders might consider that the shares they held were now of some value beyond the price paid for them. The Chairman concluded by moving the adoption of the report and accounts.

Mr. W. C. PARKINSON seconded the motion.

Mr. R. S. BENSON, referring to an item in the accounts, "loan on mortgage of debentures, £5250," inquired the amount of interest paid on this sum.

The CHAIRMAN replied that it was 6 per cent. They borrowed the money from a public company. At that time the market value of money was high; and they required 6 per cent. interest. Now, as they issued debentures at 5 per cent., they redeemed those at 6 per cent, and so lessened the amount of interest they had to pay. At present they had paid off £1750 of the sum originally borrowed. In reply to Mr. Tippetts, the Chairman further stated that the Association were interested in the Charters Towers Gas Company to the extent of £1685; and, in answer to a question by Mr. Hunt, he said the number of shares issued last year was 2810.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. PARKINSON, a dividend for the past six months was declared at the rate of 5 per cent. per annum; making with the interim dividend 6 per cent. for the year.

The Directors retiring by rotation were Messrs H. L. Hammack and J. Coates; and the former gentleman was re-elected on the motion of Mr. PARKINSON, seconded by Mr. G. H. HAYWOOD, and the latter on the motion of Mr. S. SPENCER, seconded by the CHAIRMAN.

Mr. COATES (the Managing Director and Engineer in Australia), having thanked the shareholders for the confidence reposed in him, referred to the depression which existed in Melbourne, the extent of which, he observed, was scarcely conceivable. There was hardly a company or person there who had not suffered directly or indirectly; and he could call to mind several companies who had not declared a dividend. The Metropolitan Gas Company of Melbourne, which, he supposed, was one of the best in Australia, had lowered their dividend by 3 per cent.; while in their own case there had only been a decline of 1 per cent. His own impression, however, was that the serious cloud which had been hanging over Melbourne was already passing away, and the proverbial "silver lining" had taken its place. He really believed that, before another twelve months had elapsed, Melbourne would be again in a state of prosperity—not perhaps to the extent it had been, but at all events it would be in a far better state than at present. With regard to their own business, he was pleased to report that the private consumption of gas had been, and was still, increasing. He had personally visited the whole of the stations several times, and was very pleased with the position of affairs. Sandgate, which was in the northern part of Queensland, was a growing watering-place. But Brisbane had been very much affected by the depression of late; and therefore Sandgate had suffered. In consequence of this, they had not realized the returns from this station he should like to have seen. But if the depression passed away from Queensland, and Brisbane in particular, Sandgate would certainly make a good return next year. With regard to the Northern Gas Company's works, they were situated in a suburb of Melbourne. The Surrey Hills district was one of the most remarkable parts of Melbourne for development; and Box Hill, which was a little farther out, was also a good suburb. From this district, however, they had not yet had time to get the full benefit from the mains they had laid. Generally speaking, he thought that, taking everything into consideration at all the stations, the business was healthy and strong, and that they had a good future before them. He was not satisfied with the 6 per cent. dividend, and it was scarcely enough for their Australian friends; and therefore it would be the earnest desire of all engaged on the works to produce better results. Alluding to the Seymour station, he said that they had there a growing town; and just recently some extension had been made in the street lighting. He believed the Charters Towers Gas Company would again pay a 10 per cent. dividend next year; and he was hoping it would be 12½ per cent. In conclusion, Mr. Coates referred in eulogistic terms to the work done for the Association by the Hon. Thomas Bent (Speaker of the Legislative Assembly of Victoria, and Chairman of the local Directors) and Mr. G. Swinburne, the Superintendent.

Messrs. Alfred Lass, Wood, and Co. having been re-appointed Auditors,

The usual complimentary votes were passed to the Chairman and Directors and the officials; and the proceedings then terminated.

SAN PAULO GAS COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. F. DELMAR, F.S.A., in the chair—to confirm the following resolution passed at the extraordinary meeting on the 5th inst.—"That the Directors be, and they are hereby authorized, to create debentures, providing for the payment of principal sums not exceeding in the whole £50,000, with interest not exceeding the rate of 7 per cent. per annum—such debentures to be in such form, and to be secured in such manner, and be issued on such terms (but not at less than par) to such persons as the Directors think expedient; subject to the condition that no debentures in excess of £25,000 be issued without the sanction of a general meeting."

The CHAIRMAN, at the commencement of the proceedings, said he wished to revert to one observation made at the last meeting, because it was favourable to their position. One shareholder asked why not buy more hulks instead of the land the Directors proposed to acquire. The reason was this, that the hulks did not facilitate the landing of the coal. The hulks, it was true, would save the Company demurrage; but the land would save not only demurrage, but would ensure the means of getting coal as it was required for carbonization. He was sorry to see that many people in the country, through listening to the remarks made at previous meetings, had parted with their shares at the ruinous price of £6 each. Since then the shares had gone up 40 per cent.; so that they were now at par again.

The MANAGING DIRECTOR and SECRETARY (Mr. J. Heath), replying to questions, said he attributed the rise in the value of the shares to the fact that the exchange had gone up from 11d. to 15d. The debentures would be offered to the shareholders *pro ratâ*; and applications from shareholders for shares which might remain would have first consideration. Notices would be sent out immediately; and 50 per cent. would be payable on Nov. 10, and the balance on Feb. 10.

On the motion of Mr. TYNDALE, seconded by Mr. BARSTOW, the resolution was confirmed.

The proceedings then terminated.

The Taunton Gas Company and the Corporation's Electric Lighting Scheme.—The Taunton Gas Company, in their capacity as ratepayers, have memorialized the Board of Trade against the granting of the Licence applied for by the Corporation of the town to enable them to carry out their electric lighting scheme. In the event of the Board deciding to issue the Licence, the memorialists ask that a clause shall be inserted making it obligatory on the Council to charge for the electric light supplied to private consumers a sum that will at least cover the cost of the production and the interest and other necessary expenses. The Electric Lighting Company intended supplying electricity by meter on and after the 29th ult.; but finding some difficulty in so doing, they have, instead, revised their tariff, and since the date mentioned have charged a higher rate by 2s. 9d. per annum for every 16-candle light. The average price was 16s. per annum; the new price will be 18s. 9d., or an advance of about 16 per cent. This brings the price up to about 8d. per unit, and it is in accordance with the recommendation of Mr. Gisbert Kapp.

THE PUBLIC LIGHTING DISPUTE AT HONITON.

The Town in Partial Darkness.

By the paragraph which appeared in the JOURNAL for the 11th inst., our readers will have learnt that the relations between the lessee of the Honiton Gas-Works (Mr. T. B. Purnell, of Exeter) and the Corporation of that town have not been so amicable of late as could be wished. The matter in dispute has been the public lighting of the town, the charge for which has been the subject of much negotiation on both sides since the yearly contract expired last Michaelmas. The question of the renewal of the contract, under different conditions, has been discussed in open Council meeting as well as in Committee, but without any definite result being arrived at. The old terms were £3 5s. per lamp per annum; but finding these were unremunerative, in view of the number of hours' lighting and the attention required, the lessee asked for an increase of 10s. per lamp, or a reduction in the number of hours. As an alternative, he offered to supply the lamps by meter at the same rate as that charged to private consumers. Pending the settlement of terms, the lessee continued the lighting of the town without prejudice. Matters dragged on until, about a fortnight ago, notice was served on Mr. Purnell that, unless the agreement which had been prepared was signed within seven days, legal proceedings would be instituted. He replied that unless "some satisfactory arrangement" was arrived at, he would not light the lamps after Friday, the 14th inst. He had evidently become weary of the unsatisfactory negotiations which had been going on; and he thus brought the question to a climax—throwing upon the responsible parties the blame for any accident that might result. He gave notice of his intention to the police authorities; and a similar intimation was sent to the Town Clerk (Mr. G. T. Tweed). A rumour of the step proposed to be taken in order to bring the dispute to a settlement soon spread; but, owing to the absence of Mr. Tweed from Honiton, there was some delay of action in preventing such a catastrophe. On the morning of the 15th inst., however, he communicated with Mr. Purnell, stating that, if he persisted in carrying out his proposal, the Council would take legal proceedings against him, and apply for an injunction. Mr. Purnell contended that he was legally justified in pursuing the course he has adopted; and he telegraphed to the Manager of the works (Mr. H. Purnell, his son), directing him not to light the lamps that evening, unless requested to do so as a favour by Mr. Tweed, on behalf of the Council. In the meantime, the Chairman of the Gas Company (Mr. Tucker) had received a communication from the Town Clerk, requesting him to take action in the matter; and at a meeting of a few shareholders, the Secretary (Mr. C. E. Cox) was instructed to inform Mr. Purnell that, in refusing to light the public lamps with gas, he would be violating a clause in the lease under which he held the works. The resolution arrived at was communicated to the Manager, who was afterwards sent for by the Superintendent of Police (Mr. De Schmid), who pointed out to him the damage that might be done to property by the streets being allowed to remain in darkness. Acting on his advice, Mr. H. Purnell decided to light the lamps under protest. The lessee visited Honiton in the evening; and, on discovering what had taken place, had an interview with the Town Clerk—giving him clearly to understand that the lamps were lit on the recommendation of the police, and not by his instructions. Mr. Purnell stated to a local reporter that the Council were acting towards him in a spirit of unfairness. He had not taken the course he had done without legal advice; and he was perfectly prepared to abide the consequences. With regard to the action of the Gas Company, he added that there was no clause in his lease, as they had stated, compelling him to light the public lamps. On the following night (Sunday, the 16th), the lessee again made a concession, and the lamps were lit; but as Monday did not bring a settlement of the dispute, he carried out his threat. Up to the time of closing the various business establishments, the light afforded by the shop windows was sufficient to enable the inhabitants to find their way about; but subsequently a different state of things existed, and the streets were full of people groping along in various directions, amidst remarks which were anything but complimentary to the parties responsible for the position in which the town had been left. Groups of boys paraded the streets for some hours, carrying lanterns and other lights. Several business establishments were fortunate enough to be provided with a large number of lamps; and these were placed in every available spot throughout the streets. In some cases, light was afforded by lamps fixed to poles attached to upstairs windows. Tuesday brought no change in the position of affairs; and oil-lamps were again resorted to at night for lighting the town. This state of things continued till the end of the week; and the inhabitants were suffering much inconvenience in consequence. The Lighting Committee of the Corporation had the matter under consideration; and a report from them was to be the chief business at a special meeting of the Town Council yesterday.

The Water Supply of Conway and Colwyn Bay.—At a recent meeting of the Conway and Colwyn Bay Joint Water Board, the Chairman (the Rev. W. V. Williams) announced that the Local Government Board had given their sanction to a loan of £30,000 for the water-supply scheme for the district. The money is to be borrowed from the Public Loans Board for a period of 30 years, at 3¼ per cent. The Engineer of the scheme is Mr. T. B. Farrington; and the source of the supply is Lake Cowlyd, for which £1700 has been paid.

Fylde Water-Works Company.—The half-yearly report of the Directors of the Fylde Water Company shows that the capital account has been increased during the past six months by an expenditure of £18,601, and now amounts to £304.204. On the revenue account there is a balance of £10,959. The Directors recommend dividends at the rates of 4 per cent. per annum on the preference stock, 10 per cent. on the "A" stock, and 7 per cent. on the "B" stock, all less income-tax. After paying these dividends, a balance of £2585 will remain to be carried to the next account. Works for bringing the waters of the Calder River and Calder Dyke to the existing reservoirs and works of the Company are being proceeded with.

A NEW DEPARTURE IN THE ALKALI TRADE.

[From *The Times*, Oct. 21, 1892.]

Lord Beaconsfield once called forth the mirth of some ill-informed critics by predicting an improvement in trade on the ground that the chemical industry was showing increased activity. Chemical products, in fact, enter so largely as raw materials into the processes of other manufactures, that, apart from its own importance, the condition of the trade in chemicals is no bad criterion of the condition of trade in general. One of the largest branches of chemical production is the manufacture of alkali, once much more flourishing than it is at present. This country formerly made three-fourths of the alkali used in the world; but its share has dwindled to one-half, and has been in great danger of further reduction. The main, if not the sole, reason is that the old alkali process, for the carrying on of which an enormously expensive plant exists in this country, cannot compete in point of cheapness with the ammonia-soda process introduced by Messrs. Brunner, Mond, and Co. That process, being now in use in small factories all over the Continent, has reduced our export trade to very small dimensions. The old or Leblanc process has, indeed, only one advantage—the collateral production of chloride of lime, or bleaching-powder. This material, originally a bye-product of the alkali process, has become the mainstay of the old manufacturers, who are obliged to sell their soda for what they can get. The amalgamation of Leblanc manufacturers into the United Alkali Company was carried out chiefly with the object of putting an end to competition in bleaching-powder; and its efforts to keep up the price have been greatly favoured by the cholera scare, with its demand for disinfectants, which has raised the price £2 per ton.

In the ammonia-soda process, the chlorine of the salt, which is the raw material of both processes, is run down the sewers in the form of chloride of calcium. Regarded merely as a waste product, this salt has the enormous advantage over the foul-smelling alkali waste of the Leblanc process that it is odourless and soluble. But waste of this kind is an offence to the soul of a chemist like Mr. Mond, even though his works pay in spite of it a dividend of 50 per cent. He has accordingly turned his attention to the problem of utilizing the chlorine as well as the sodium of the Cheshire brine wells; and, by combinations of the most striking boldness and ingenuity, that problem has been solved. Chloride of lime made by the new process is actually upon the market, a large and efficient installation is at work, and the increase of the output to any required extent is a mere question of time and plant. The new chlorine process has been made to dovetail in the most beautiful manner with the old ammonia-soda process; and the combination does its work with ideal completeness. The raw materials are salt, consisting of sodium and chlorine; chalk, consisting of lime and carbonic acid; and coal. The products are soda-ash, consisting of sodium and carbonic acid; bleaching powder, consisting of lime and chlorine; and energy, derived from combustion of coal, and employed to effect the new grouping of the four substances in question.

We may take the operations to begin with the destructive distillation of coal. This is carried out in coke-ovens, and the products are (*a*) combustible gases, (*b*) ammonia, and (*c*) coke. The combustible gases are stored for the supply of the heat required at subsequent stages; the ammonia goes to repair the inevitable waste of that substance, a large quantity of which forms, as it were, part of the permanent plant; and the coke is used to burn limestone in lime-kilns. By this process chalk or limestone is split up into carbonic acid and caustic lime. The caustic lime plays an important part later on. Brine as pumped from the well is now treated first with ammonia and then with carbonic acid. Bicarbonate of soda is formed, and crystallizes out; while chloride of ammonium remains in solution. This is the fundamental reaction of the ammonia-soda process. It was discovered as long ago as 1838 by two Englishmen—Messrs. Dyar and Hemming; and about 20 years ago was successfully applied to soda manufacture by M. Ernest Solvay, of Brussels. Owing to want of capital, his operations were restricted; but his patent rights in England were acquired by Mr. Ludwig Mond, who, with Mr. Brunner, started works for production upon a large scale. It is at this point that the new process now perfected parts company with the Solvay process.

We have obtained, as the result of the proceedings so far, bicarbonate of soda in the solid form, caustic lime, and a solution of ammonium chloride. The ammonia-soda process recovers the ammonia by boiling the ammonium chloride solution with the caustic lime. Ammonium chloride gives up its chlorine to the lime, forming chloride of calcium; while free ammonia passes off, and is carefully collected, to be used again and again with fresh brine. No means having been discovered of utilizing the calcium chloride, it was treated as waste, and carried away all the chlorine of the original salt. Instead of boiling his ammonium chloride with lime, Mr. Mond freezes it by means of an ammonia-refrigerating apparatus, which, by passing the gas through an endless cycle of condensations and expansions, produces any required amount of cold. Treated in this way, the ammonium chloride crystallizes out of the solution. It is dried, and subjected to the opposite extreme of temperature. Somewhere about a red heat, it sublimes, and probably suffers temporary decomposition—the hydrochloric acid and the ammonia existing in the vapour as separate and uncombined gases. The vapour is passed over magnesium oxide mechanically arranged so as to present the largest possible surface. Then comes the characteristic reaction of the new chlorine-recovery process The magnesium oxide gives up its oxygen, which combines with hydrogen to form water. In place of the oxygen, the magnesium combines with the chlorine of the ammonium chloride, and free ammonia is obtained and collected in the usual way. At this point, therefore, the account stands thus: Bicarbonate of soda in the solid form, only needing to be heated to give soda-ash; the ammonia used in the process wholly recovered, barring a percentage of waste, in its original gaseous state; and the chlorine wholly fixed as magnesium chloride. Now the reaction which produced magnesium chloride is exactly reversed. Hot air is passed over the chloride as hot chlorine was passed over the oxide; and as the chlorine of the ammonium chloride drove out the oxygen of the oxide, so now the

oxygen of the air drives out the chlorine of the chloride. The free chlorine is passed over the caustic lime from the kilns after it is slaked with water, producing bleaching-powder, and the magnesium oxide is left in its original condition ready to decompose a fresh batch of ammonium chloride. Thus the chlorine of the original brine is combined with the lime of the original chalk; the soda of the brine is combined with the carbonic acid of the chalk; the ammonia and the magnesium oxide employed in the process have been given back in their original forms; and nothing has disappeared except the coal, which has furnished the heat required to effect the transformation.

The least scientific of readers who has followed our description of this new process with ordinary intelligence can hardly fail to be struck by its artistic completeness and economy of material. Chemists will admire Mr. Mond's bold and dexterous employment of the balanced chlorine and oxygen reaction; and they will appreciate the scientific knowledge and practical skill required for its successful application to huge masses of material. Taken separately, some of the operations involved are of a decidedly costly character; so much so, indeed, that one could easily understand an *a priori* verdict to the effect that they are inadmissible in the manufacture of substances the price of which is low in relation to their mass. But all the different operations fit and supplement one another so exactly, and with such complete utilization of materials and resources, that the process as a whole becomes economical and profitable. It is, indeed, a triumph of applied science which could only have been attained by one who, like Mr. Mond, could bring to the solution of the problem a thorough scientific training and a thorough grasp of scientific principles. There are plenty of other victories to be achieved; but they will fall to men similarly equipped, and not to manufacturers content, as our manufacturers too often are, to proceed by obviously imperfect and wasteful methods, without serious and adequate effort to reach higher things.

By a happy accident, this new process, while dealing a heavy blow at the alkali manufacture as hitherto carried on in England, redresses the balance in favour of English trade. One-half of the soda-ash of the world is now made by the ammonia-soda process, in presence of which the Leblanc process manages to exist only in virtue of its bleaching-powder. Even that mainstay has been found so precarious that the price has had to be artificially maintained by combination among the makers. It is not in the nature of things that this country could permanently hold a trade thus bolstered up, especially in view of the fact that there exist at Stassfurt and elsewhere unlimited deposits of potassium and magnesium chloride, the utilization of which for the production of cheap bleaching-powder is only a question of time. The new Mond process gives the cheap bleaching-powder required, and throws the natural advantages on the side of this country, where we have abundant supplies of salt, limestone, and coal in close proximity. At the same time it gives the Brunner-Mond Company a commanding position even among ammonia-soda manufacturers—enabling it to undersell them abroad. That Company's works cover 20 acres of ground, employ a plant costing about a million sterling, and find occupation for upwards of 3000 workmen. The new output of bleaching-powder will undoubtedly lead to further extension, in one form or another, of that already gigantic industry. It may be not without interest to add that the processes go on continuously and uninterruptedly from year's end to year's end; the staff being divided into three wholly independent shifts.

More Gas Consumers on "Strike."—Following the example of Marseilles and Lyons, a number of the gas consumers of Béziers have decided to discontinue burning gas, because the Gas Company in that town have refused to accede to a demand for a reduction in price. The present rates charged are 30c. and 20c. per cubic metre for lighting and motive power respectively; and the consumers clamoured for a concession of 10c. on the former, and 5c. on the latter figure. As they did not get what they asked for, they have determined to burn petroleum in lamps which are stated to effect a saving of 40 or 50 per cent. on the cost of gas. The strikers hope that, if they hold out long enough, the Company will yield, especially as, it seems, some establishments are now being supplied at the lower rate demanded.

Water Supply in the Wakefield Rural Sanitary Authority's District.—Referring to the paragraph on this subject in the JOURNAL for the 4th inst., the Wakefield Rural Sanitary Authority have now resolved not to further proceed with the contemplated construction of a service reservoir for the supply of Warmfield, Crofton, and Sharlston, the cost of which it was proposed to throw upon the ratepayers of those townships. In order to supply these high-lying districts, the authority have asked the Wakefield Corporation to allow the pipe supplying the higher parts of Warmfield to be connected to the Corporation main. The Authority have also passed resolutions empowering their Clerk to apply to the Local Government Board for a loan of £620 for the purpose of extending the water supply at Alverthorpe-with-Thornes, £925 for a like purpose for East Ardsley, and a similar sum for West Ardsley.

Profit-Sharing in the Iron Trade.—Sir A. Hickman, M.P., has addressed a letter to his workmen at the Spring Vale Furnaces, Bilston, Staffordshire, in which he says: "About a year ago I told you that I had determined to give a share of the profits made at Spring Vale between July 1, 1891, and July 1, 1892, to those men who had worked there all the year. I said then I hoped the result would be a substantial sum for each of you, which might be a nest-egg, and induce you to make an effort to lay by something against illness, old age, or temporary want of work. The accounts for the year are made up; but, I am sorry to say, the results are not so good as I expected," Sir Alfred then goes on to give the reason, which included reduced prices and increased costs through the Durham strike. But he says that, notwithstanding these drawbacks, the men's share will amount to 2½ per cent. upon the whole of the wages received during the year. In conclusion, the writer remarks that he expected to be repaid, at any rate, some of the amount given to the men, by increased attention and greater care on their part; but he cannot say that, except in a few instances, he saw any evidence of this having been realized. It is stated that the scheme is to be tried for one year longer.

THE METROPOLITAN WATER SUPPLY COMMISSION.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* W. OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH, *Commissioners.*)

Nineteenth Day—Friday, Oct. 7.

Mr. *H. J. Marten*, M.Inst.C.E., was the first witness to-day. He stated that, in the exercise of his profession, he had constructed waterworks in various parts of the country, from which three-quarters of a million of people were now being supplied with water. His first connection with the question of the London Water Supply was in 1849 or 1850, when he gave evidence before the then Board of Health as to the conversion of the supply of Wolverhampton from an intermittent to a constant supply. In connection with Mr. Rofe, he was now the engineering adviser of the Conservators of the Thames, from whom he had received instructions to consider whether, by means of storeage reservoirs to be constructed in the upland valleys of the Thames, such an augmentation of the present flow of the river might be secured as to allow of twice the quantity of water now being drawn from it for the supply of the Metropolis being abstracted therefrom by the Companies, without reducing the dry-weather flow past Teddington Weir below 200,000,000 gallons per day. In considering this problem, they had first to ascertain the daily average quantity of water drawn between Sunbury and Molesey Weirs for the supply of the Metropolis in the year 1890; and they found, by reference to Sir Matthew White Ridley's report, that the average was then about 90,000,000 gallons a day. In hot and dry weather, this quantity, of course, was considerably exceeded. They found, for instance, that in July of that year, the whole abstraction averaged 170,000,000 gallons a day; though, on account of previous rainfall, the quantity flowing past Teddington Weir never fell during that month below 234,000,000 gallons a day. In the month of August, however, while the abstraction was only 101,000,000 gallons a day, the minimum quantity passing over Teddington Weir had fallen from 234,000,000 gallons a day to 154,000,000 gallons. This quantity was reached on a Sunday, when, as Mr. Hawksley had explained, the flow was practically less than on other days. He was informed by the Thames Conservators that that minimum flow had never been before obtained. There were only nine days in that particular month during which the flow passing Teddington Weir was under 200,000,000 gallons a day; and the deficiency during those days only averaged 23,000,000 to 24,000,000 gallons a day below the 200,000,000 gallons. At all other times throughout that extraordinarily dry year (the rainfall in which over the Thames basin was 27 per cent. below the average), the flow past Teddington Weir exceeded 200,000,000 gallons a day; and the average for the four months July, August, September, and October, 1889 (including the nine days referred to), gave an average flow past Teddington Weir of 297,000,000 gallons a day over and above the quantities taken by the Water Companies. Practically, therefore, except on very rare occasions—and those for a few days only of extreme heat and drought combined—the quantity of water passing Teddington Weir may be stated as exceeding 200,000,000 gallons a day over and above the quantity taken by the Companies. Taking the greatest average monthly abstraction by the Water Companies at 107,000,000 gallons a day (which quantity was reached in July, 1887), the problem was to make provision for any such deficiency as occurred in August, 1887, and for an abstraction equal to double the greatest quantity now drawn by the Companies from the river, without reducing the flow past Teddington Weir below 200,000,000 gallons a day. To do this, storeage reservoirs would have to be constructed capable of delivering about 130,000,000 gallons a day during periods extending over an aggregate of 120 days, or a total of four months in each year. They then came to consider how long 107,000,000 gallons a day abstracted from the Thames in addition to the present like quantity would last for the supply of the Metropolis. The basis of the solution of this question was twofold—first, the rate of increase in the quantity of water at present being abstracted from the Thames by the Companies; and, secondly, the rate of increase on the hypothesis that the whole of such additional quantity would be taken from the Thames, exclusive of any other sources of supply. They found that, on the first-named basis, the additional 107,000,000 gallons a day would not be exhausted for at least a period of between 40 and 50 years from the present time, and would then only be reached in periods of great heat and drought combined; whilst, on the second basis, and without any allowance for increase from other sources of supply—such as from the Lea, and other like surface streams, or from wells sunk outside the Thames basin—the additional 107,000,000 gallons would probably be exhausted in about 33 years. It was in both instances rather a longer period than Parliament looked forward to in the case of water-works supply, which was, he believed, 25 years. In dealing with the Metropolis, he would look forward to a more moderate period. They came to the conclusion that it was hardly probable the whole of the increase for the supply of the Metropolis would have to be abstracted from the Thames basin by pumping—either directly from the water flowing in the river itself above the intakes, or indirectly by abstracting underground waters within the basin, which, if left to themselves, would find their way into the river bed above that point, in the shape of springs—because storeage as proposed for the Thames might possibly be resorted to for increaseing the supply from the Lea and its tributaries, and because the underground supplies in various outlying districts, which were now being drawn upon, were not by any means yet exhausted. Taking all things into consideration, they were of opinion that an addition of 107,000,000 gallons a day to the present maximum quantity abstracted from the Thames would be sufficient for the increasing requirements of the Metropolis for the next 40 years. Then, having arrived by these methods at the possibility—in fact, they might say the certainty—of the Thames Valley being able to supply that quantity of water, they looked about to see how this water could be stored and paid out at the right time. In this investigation, they were accompanied and otherwise aided by Dr. Henry Woodward and Mr. Horace Woodward, both experienced geologists; and were guided to some extent, as to the value of the land which might have to be taken, by Mr. Franklin, land agent to the proprietors of several large estates

in the Thames basin above Oxford. They took precautions to ascertain both the geology and the cost; and they came to the conclusion, from inspections which were made upon the ground and the advice of their geological friends, including Mr. Topley and Mr. Boyd-Dawkins, that the sites they had selected were practicable for the making of storeage reservoirs. The proposed sites were nine in number—on the River Windrush, above Burford; on the Sherborne Stream, above the junction with the River Windrush; the River Cherwell, near Moreton Pinkney; Sor Brook, Broughton, near Banbury; River Swere, near Adderbury; stream near Deddington; River Dorne, near Woodstock; River Glyme, above Woodstock; and the Thame at Hardwick, near Aylesbury. The cost of these nine reservoirs, including land, they estimated at £1,962,225. In looking out for these sites, they had endeavoured, as far as possible, to avoid the railways, canals, and so on which occupied the valleys; and, in addition to that, they thought it was better to divide the storeage into several points rather than to depend upon one or two very large areas, so that London might not be disappointed in a time of great importance.

The CHAIRMAN: At what level would you draw the water over the reservoir?

Witness: If you deduct the height of the embankment, less 5 feet, you would have that approximately. He then went on to say that 415 feet was the height above Ordnance datum in the first reservoir. The usual method of ascertaining the available rainfall was first to deduct one-fifth or one-sixth from the mean annual rainfall—the figure so arrived at representing the average rainfall for three consecutive dry years; and, secondly, to deduct therefrom for loss by evaporation and absorption (say) from 12 to 14 inches. The mean rainfall over the whole of the Thames basin was estimated at from 25 to 27 inches; the mean flow of the river above the intakes representing about 9 inches—thus showing an annual loss over the whole basin of from 16 to 18 inches. This estimate was founded upon a statement by Major-General Scott, before the Guildhall Committee, in which he gave the average flow past Teddington Weir as being 1,100,000,000 gallons a day, equal to 8 inches, from the area above the intakes of the Companies, which he put at 2,217,600 acres.

The CHAIRMAN asked witness if he had made any calculation as to the population which would be above the reservoirs respectively.

Witness replied that he had. He had a very careful survey made; and found that the population above these various reservoirs would be about one person to five acres, and that of the land which formed the gathering-ground 56 per cent. was arable and 44 per cent. was pasture. Taking the animals over that area, there was rather less than one animal to an acre. The population was not increasing, it was rather decreasing. There were one or two very considerable urban communities dotted about; and they would have to deal with the sewage of those, as they would have to shortly under any circumstances. This sewage went into the Thames at the present time; and that would have to be avoided, so as to prevent any nuisance arising. Chipping Norton was just outside the shed of the eighth reservoir, and Banbury was below the reservoir sites. He had found that there was a reservoir which had been in existence for 100 years in Blenheim Park, which was upheld by a very unscientific embankment. So far as he could judge, that reservoir was a fairly light one. There were some springs at the foot of the embankment; but these he thought were independent of the lake. This reservoir was about 130 acres in extent, and was a perfectly stable affair. The aggregate capacity of the enumerated reservoirs would be about 20,000,000,000 gallons, or nearly double the available capacity of Lake Vyrnwy reservoir; while the aggregate area of the reservoirs would be considerably more than double the area of that lake with Lake Bala added to it. The reservoir embankments would all be of moderate height—averaging less than 50 feet, or much less than those frequently constructed in other parts of the country—and the puddle trenches could all be sunk down to sound measures at reasonable depths.

Questioned by the CHAIRMAN as to the method by which the water from the reservoirs would pass down the valley of the Thames, by pipes or in the open river, witness stated that some of the reservoirs would be at a sufficient elevation to make it possible to send the water from them to the Metropolis without pumping. But in saving pumping, there would be the great expense of pipes to be considered. In favour of sending the water down the open channel, it had to be remembered that thereby an immense amount of aëration, which was exceedingly valuable, would be obtained; and, so far as he (witness) understood from scientific evidence, the water was not deteriorated in passing down the river to the Companies' intakes—that at the intakes it was, in fact, almost better than at any other part. As to the quality of the water at the intakes compared with what would be found in the proposed storeage reservoirs, it was to be observed that what would be stored would be an improving water—to a certain extent flood water would come into the reservoirs; and this, no doubt, would be loaded with a certain amount of alluvial material washed from the surrounding gathering-grounds. This material would settle down in the reservoirs and be got rid of in the water; and in the settling down, other things in the water, that were sometimes disadvantageous, would be taken out. So that the water from the reservoirs would be quite equal to, if not better than, the average of the water coming down the Thames in ordinary times; and in dry seasons, it would no doubt very much improve the quality of the water in the river. But he did not feel quite equal to answering the question whether the aëration of which he had spoken would cause the water from the reservoirs to be delivered at the intakes in a better condition than if it came all the way in pipes. Aëration was of great value; and they could not, of course, get that in the pipes, in which the water would be bottled up, and whatever went in at one end would come out at the other. But while in the pipes aëration would be lost, the water there would not get any additional contamination.

In reply to Sir G. B. BRUCE, witness said he agreed with Mr. Hawksley's view, that 25 gallons of water per head per day was a supply sufficient for all purposes, if there was proper supervision of fittings.

Examined by Mr. HILL, concerning the drainage area of the proposed reservoirs, witness mentioned that it consisted of 56 per cent. of arable land and 44 per cent. of pasture, including the meadow land; and the total area was 124,000 acres. He did not think that any material harm could accrue to the water stored from the floods over the cultivated land. The surface was to a great extent porous. As to the sites of the reservoirs, he did not regard them as doubtful, excepting, perhaps, the two he had specially referred to; and those two, he believed, would turn out satisfactory. Moreover, their scheme of construction of reservoirs being progressive, to be carried out step by step and as the requirements arose, they could profit by experience and fix on the best available sites.

Mr. MANSERGH: You would call these rather shaky sites, these two you have specially referred to—not what you would begin to make use of with a light heart?

Witness: I should feel a certain amount of responsibility about them; but I felt a good deal more doubt about them in the first instance than I do now. The second view I took of those sites when I had not the geologists with me, and the consideration of all matters connected with them, made me feel rather more favourable to them than at first. Replying to further questions from the same quarter, he pointed out that the absorption over the area of the reservoirs by vegetation would be rather less in proportion than that by the ground—the ground being porous would absorb rather more water than the plants would. But he thought that, though the ground was very porous, they would catch a very large proportion of the water.

Professor DEWAR wished to know if a watershed unpopulated by man or animals and uncultivated, could be found to supply 200,000,000 gallons.

Witness: Not in England.

Professor DEWAR also desired to know how long water would be stored in the proposed reservoirs before being used.

Witness said they would be in process of storing for eight months in the year; and flood water certainly never would be used until many days after it was collected.

It would be stored a certain number of days in any case; and during that storeage, it would undergo a natural purification?—Yes.

In further reply to Professor DEWAR, witness pointed out that very frequently the rights of mills on the streams were bought out, when a water supply for a town was sought, to save the expense of compensation water. It was sometimes advantageous to buy up the value of the mechanical power of a stream which was used and reserved for that power, but which offered a good water supply for domestic and trade consumption; but it depended upon circumstances, whether it was least expensive to buy up the mills or to go elsewhere for the water supply sought.

Reverting to the question of bad sites for the reservoirs, in reply to Sir A. GEIKIE, witness said he thought perhaps that the two sites alluded to had been ear-marked with the unfavourable phrase without any absolute reason. Speaking again of compensation for abstracting water, in answer to Mr. HILL, witness mentioned that that was usually paid in water rather than in money; because when in water, everyone—millowners, landowners, &c.—were paid, whereas when in money, they had not done after paying the millowners, and a good many riparian questions were liable to arise.

Mr. *H. Rofe*, M.Inst.C.E., was the next witness. He explained that he had had 30 years' experience in the construction and management of water-works; and since 1868 had been continuously engaged in making large storeage reservoirs. He went on to state that he joined Mr. Marten in the preparation of the report upon which that gentleman had been examined; and that, since preparing it, he had had a further opportunity of inspecting the sites of the two reservoirs proposed there, in company with Professor Boyd-Dawkins, Mr. Topley, and Messrs. Woodward. He had some modifications to suggest. [Witness explained them by the aid of drawings handed in.] By these alterations, the capacity was increased from 5,971,000,000 to 7,810,000,000 gallons; and the result of some other alterations would enable them to get a good deal more water out of the Windrush shed. They proposed to use these reservoirs in a somewhat abnormal way; they were not taking from them day by day. Reviewing his observations, he remarked that he had given the Commission shortly what the result would be—viz., that they increased the capacity of one of the reservoirs to 7,810,000,000 gallons, which was in excess by 1,093,000,000 gallons of the capacity which would be required to deal with the rainfall in the usual way (that was to say, if they were taking the daily quantity, as would be done with the ordinary storeage reservoir), but decreased the capacity of the other one to practically 600,000,000 gallons. Of course, the figures were very approximate, taken out from the Ordnance map in this way: Connecting the one reservoir with the Windrush by means of the tunnel indicated on the section, was equivalent to adding 6925 acres to that gathering-ground. If they took the 10 inches of available rainfall on the Sherborne area, and passed it through into the Windrush, it would be equivalent to an available rainfall of 4,293,000 gallons per day; and if they added this quantity to the 29,855,232 gallons which was the total daily yield of the Windrush gathering-ground, they would get a yield of 34,148,000 gallons per day. To store this quantity over 225 days, which would be the proper proportion for a rainfall of this character, they would require a capacity of 7,683,000,000 gallons, as against the 7,810,000,000 gallons provided; so that he had a margin to enable him to deal with the rather abnormal use of this reservoir. Now, the compensation for the entire area draining into the Sherborne reservoir would be discharged out of that reservoir. It was just big enough to give its own compensation for the whole area. Consequently, the Windrush had only to provide compensation for its own area—that was to say, it had to provide 9,951,744 gallons per day. If multiplied by 225 days, the proper proportion of storeage, it came to this—that they had a storeage capacity mortgaged for compensation of 2,239,000,000 gallons. If they deducted this from the total content of 7,810,000,000 gallons, they would have remaining 5,571,000,000 gallons available for use in 120 days. This gave in reality 46,425,000 gallons per diem for that period.

Mr. HILL: Is that instead of the 37,000,000 gallons?

Witness: No, it will not be, because the 37,000,000 gallons include the dry-weather flow, I think. But during the 120 days, there will be a dry-weather flow of one-quarter of a cubic foot per second per 1000 acres. I put it down at that; and I think it is fair for that shed. The

43,000 odd acres of the Windrush and the 6000 odd acres of the Sherborne brought into it are equivalent to 6,843,000 gallons per diem; making the total for the 120 days 53,268,000 gallons per diem available to be drawn down.

Sir G. B. BRUCE remarked that he believed witness had a further suggestion as to reservoir No. 6.

Witness said he did not know it at the time, but he might say that this was one of the reservoirs—or rather one of the sites—which Mr. Hawksley in his evidence had referred to as doubtful. He marked two; and witness told him that morning what he proposed to do—viz., to make an alteration—before he knew that Mr. Hawksley had marked the map.

Which are they?—Those are the ones at Woodstock, which are the sites mentioned as doubtful.

Then supposing these sites, or several of them, were found to be objectionable on account of the strata upon which the water has to rest, are there any other sites which you have looked into where the same objection would not apply?—There are none that I have looked into carefully; but it is obvious, from the maps, that there are on the clays many other sites where the objection would not apply.

Do you feel quite sure about that?—Quite clear. May I correct an expression of Mr. Mansergh's? He put a question to Mr. Marten to the effect that Mr. Hawksley did not intend to take the flood waters into his reservoir. Mr. Hawksley's remark applied, if I recollect rightly, to the water which he would pump into the Staines reservoirs, not into the storeage reservoirs in the upper valley. Continuing, witness said he concurred in the views of Mr. Marten, expressed that morning. The only addition that occurred to him was that there were several questions put to Mr. Marten regarding the sufficiency of their estimate as to the quantity. He pointed out that he did not go into that, because the instructions did not refer to it. They had to provide for a certain quantity without reference to the increase of the population in the Metropolis. The instructions were, whether twice the quantity of water now taken could be drawn from the Thames for the supply of the Metropolis without reducing the dry-weather flow past Teddington Weir; and he did not consider with Mr. Marten the period in which that quantity would be required, excepting incidentally, as was their duty. Also with regard to the other question, as to the quantity of water per head which ought to be used, his experience—and it was a wide one—was that, in supplying large populations, 25 to 26 gallons per head per day was ample to provide for all large communities, where the trade consumption was a fair one. If they went to a place like Middlesbrough, where two-thirds of the consumption was for trade purposes, it was, of course, a different thing altogether.

In reply to Sir A. GEIKIE, witness said he could not deal with the question of the villages along some of the watersheds. Mr. Marten went entirely into that; but, at all events, he remarked, the drainage of all the villages went into the Thames and into its tributaries now. Therefore, if the water went into the reservoirs and had a chance of self-purification there, it must be better than what they now obtained from the Thames. They would effect that if they did nothing more; and surely they would do something more than that. As to the comparative merits of the two schemes of carrying the water down in the Thames and taking it down in pipes, he had no opinion. There were very good reasons evidently given for carrying the water down in the river; but he was bound to say, if he were designing a scheme for London, he should consider very carefully whether it would not be wiser, even if it would be an additional cost, to put it into pipes. But it was a mere matter of opinion.

By Professor DEWAR: Undoubtedly, when he spoke of transferring the water by means of the river or of pipes, he intended that subsequent to the transit the water should be filtered—the ultimate result in either case depending upon good filtration.

Mr. HILL re-directing attention to the dam to the reservoir in Blenheim Park, witness pointed out that it was of value to them in these considerations only, in that it showed that suitable works could be put in formations of the character found there. He was quite clear that, if that very unscientific dam would do, any one who knew what he was about could put a much better and safer one there. They could, in his view, make a practically tight reservoir. Look, he said, at the hill-sides in some of the sections; see the rocks colored right up to daylight. They went on the ground and found those slopes well-grassed, naturally puddled. Again, take a section where the alluvial deposit was shown; and they would see what a large area of the bottom of the reservoir was absolutely covered with an impervious material. At the same time, he did not for a moment put this site forward as an ideal one; nor did he say it was the best that could be found in the Thames Valley.

Mr. HILL: Would you get the water?

Witness: Yes.

From the drainage area?—Yes.

With this pervious material?—Yes; because my puddled trench is down to the impervious, and the water is bound to be drawn out into the reservoir.

Might not it go laterally?—Those sections show in some cases that it might travel laterally; but it would be a very difficult thing for it to do, because, even those oolites which we see, are mixed up with beds of marls to the extent of 25 per cent.

Mr. *John Hopkinson*, M.Inst.C.E., the next witness, stated that for the last 16 years he had made a special study of the geology of Hertfordshire, and had collected records with regard to the rainfall and other matters of that description. The average rainfall he estimated at 26·07. The average percolation, according to the results of experiments made at Nash Mills and at Lea Bridge, was about 6¾ inches; and the average evaporation, 19¼ inches. He regarded that water which had percolated as available for water supply. They had to allow, in addition, for a certain quantity of water which flowed off the surface. Taking the area of chalk which was covered by the ordinary surface soil, as a rule no water would flow off the surface. It was most exceptional to find any water in a chalk country flowing off the chalk surface. Of course, if there were thick beds of clay, it did. In percolation, the water came out into the rivers, or at the sides of the rivers sometimes. He estimated roughly that on impermeable beds one-half the amount of water which percolated through permeable beds would flow through the surface. It was perhaps between three and four inches. The general result, adding that, was that the yield of the Colne area above Harefield would be 57,500,000 gallons per day; and above Lea Bridge, 54,500,000 gallons. The total yield of the two areas, according to his estimate of the ordinary rainfall, was about 132,000,000 gallons a day. He condemned the storing of flood water, because it brought down the refuse on the land—manure and everything. They found, by an examination of the reports of the analysts for the Water Companies, that the flood water always had impurities in it. Even after the water had made a settlement in a reservoir, and had been filtered, he should not consider it fit for drinking purposes. It was not wise to take water which had originally come down in a turbid state, whatever treatment it might afterwards receive, as this water had not the advantage of ordinary water in being oxidized as it came down the river. With regard to the amount of water which was really to be relied on, he did not think that, without prejudicing the interests of the county of Hertfordshire to some extent, it was at all wise to pump water from the chalk; because whatever was pumped, must lower the surface and must reduce the amount of water in the underground reservoirs, especially in extremely dry years. He did not believe any injurious effects would be felt in wet seasons. Less of that water should be taken than was at the present time. With regard to the way in which the amount of percolation was obtained, the gauges used were iron cylinders, filled in the first place with chalk in such a manner as to represent as nearly as possible the usual condition of the soil. In an artificial gauge, the result was that rather more water was likely to percolate than through natural soil. In the case of the Rothamsted gauges, however, the result had been to show that there was no appreciable difference in the amount of percolation. The figures he had given were an approximation. The amount of percolation, taking the three dry years, 1869-1870, at Nash Mills was 3·75 inches. There might in such years be a balance left from previous years, if not pumped away; but taking such a long period as six years, they had less than 4½ inches. They might, therefore, he thought, rely upon 4 inches of water in a succession of dry years.

Mr. MANSERGH: Do you think that all the water that falls upon Hertfordshire, if allowed to take its free course undisturbed by any pumping, would get into the rivers of Hertfordshire, or where would it get out?

Witness thought there was a possibility that a certain amount of water might be carried through the chalk under London.

The CHAIRMAN: When you say that no water should be pumped, do you mean that none should be pumped in Hertfordshire out of the chalk; or that nobody below Hertfordshire near London, under whom the chalk is lying, should pump any water at all, for fear of damaging Hertfordshire?

Witness explained that he did not mean to keep exactly to the geographical limit of Hertfordshire. He would say rather it should not be pumped from the basins of the Colne and the Lea above the points where the London clay covered the chalk—the basins of the Colne and the Lea outside the London clay—except what they required for their own purposes in Hertfordshire.

Dr. OGLE asked what ground witness had for thinking that filtration could not remove disease germs.

Witness stated that he formed that conclusion from different sources but he had not read the results of Dr. Frankland's experiments, and was therefore not aware that 98 to 99 per cent. of the microbes in water were removed by the filtration of the Water Companies.

In answer to Sir A. GEIKIE, witness stated that he had made observations with regard to the flow of water in the chalk on the River Colne. He had seen the water disappear from the Colne, leaving it almost dry, and had then noticed it flowing lower down. Therefore, he assumed that the general flow of the water in the chalk was parallel with the flow of the rivers as a rule.

Mr. *U. A. Smith*, C.E., then submitted a statement on behalf of the Hertfordshire County Council, to which authority, since 1875, he had been surveyor and engineering adviser; and before that date he was deputy county surveyor. He understood that the New River and East London Water Companies, in estimating the probable increase in the population to be supplied by them in the future and the quantity of water required for such purpose, gave as their resources to meet the coming demand the amount of water still remaining in the chalk formation to the North of London. The two Companies were now taking in the Lea Valley from the Chadwell and springs 12,200,000 gallons per day; and they proposed to take from such sources, for the purpose of meeting the increased demand in the future, 58,000,000 gallons a-day. This was in addition to the quantity of water they now took, and proposed to continue to take, out of the Lea.

The CHAIRMAN: Are you quite correct in saying that the New River and East London Companies are taking this water that you mention from the wells and springs?

Witness: These figures were abstracted from the original statements prepared for the Companies. With regard to his other statements, he mentioned that great difficulty had been experienced in getting definite information, and much that he submitted was second-hand. But there was no doubt that the rivers and streams in Hertfordshire had for several years past been getting lower and declining in their flow. Springs overflowing into the rivers were less strong than was formerly the case, while some had stopped flowing; and the level of the water in the wells was lower than formerly, some having ceased to yield a supply. This was not due to any reduction in the amount of annual rainfall. The flow of the streams varied to a certain extent with the increase or decrease of the rainfall; but the decline of which he spoke had been a gradual one for many years past. A summary of rainfall statistics which he submitted showed that the average rainfall during the 20 years ending with 1890, had been much above the average of any previous decade—for the last decade 7 per cent. above the mean for the century, and for the previous decade 15 per cent. above the mean—so that, on the basis of rainfall, they might expect that the flow of the rivers would have increased rather than decreased during the period referred to. He attributed the chief, if not the only cause of the general decline in the flow of streams and strength of springs to the large quantities of water abstracted from the chalk by pumping from below the line of saturation in that formation. There might be a lowering under London; and

that would have a like effect upon the water of his county. But he thought that the wells of the New River Company, particularly in the upper part of the Lea, must be draining the county—the water that there came to the Company must come from the county, and a good deal of it came from the valley of the Colne. So far as he felt able to frame a theory under circumstances of great difficulty, that was the one he put forth.

The CHAIRMAN, closely examined witness to lead up to a suggestion which his Lordship wished to make—namely, that the fair way to calculate the effect of a series of years in the matter of rainfall, would be to take, not the decades—from ten years to ten years—but the mean of several successive ten years or of shorter periods.

Witness agreed entirely with his Lordship. He said the only argument he based upon what was stated in the table submitted, was that, in the last 20 years, the rainfall was in excess of that of previous periods.

The CHAIRMAN pointed out that it did so occur that, by taking those periods of ten years, the witness in each case happened to shut out one or two years that made a material difference. Following on from that, his Lordship observed that witness made a suggestion which was so contrary to what he should have expected, and to his experience and previous knowledge, that he felt bound to ask the grounds for it. Witness said: "The decrease of the flow of the streams has been attributed, at least to a certain extent, by some who have not fully studied the subject, to the under drainage of lands for agricultural purposes; and it is said that, in consequence of drainage, land discharges more rapidly water which formerly was given out gradually, and that the result of this is to reduce the ordinary dry weather flow of rivers and increase the floods." That was a statement which he made quite frankly; and then he went on to say: "The under-drainage of land has quite the contrary effect." Asked on what he based that, he replied on his own engineering knowledge. When not drained, land was generally in a supersaturated condition; and the water falling on it would flow off very rapidly and assist in enlarging the floods. When it was drained, the land above the level of the drain was to a great extent dry, and took up the water and held it more readily, and gave it out more gradually. He had always looked upon that as a fact; and the other view as only a popular prejudice.

Does not drainage tend to keep the land drier?—Exactly.

Then to get it drier, the water must go more quickly from it?—Not from it but into it more quickly. Questioned concerning an illustration he had given of the effect of the pumping which had been referred to, witness stated that, before certain pumping began in 1891, the level of the water in the chalk was within 4 inches of the top of a bore-hole about three-quarters of a mile below the pumping-station; and after the pumping, this water sank rapidly, until two months afterwards, it was 4 feet below the top. During that time the river got gradually drier. It was a dry period; but the river dried more rapidly than it would have done by the operation of natural causes.

Sir A. GEIKIE, reverting to the view witness took of the effect of drainage, remarked that it was exactly the reverse of what he himself had been accustomed to. Drainage made the water run off faster, he had always understood.

Witness repeated that it had been popularly supposed to be so. Concluding, he mentioned that the authority he represented objected very strongly to water of their county being taken away for the supply of London. If water were drawn from the chalk below the level of saturation, that would affect their rivers; if it were simply taken from the open rivers south of the county boundary, it would not interfere with them—that would be simply taking it after they had done with it.

The Commission then adjourned.

PLYMOUTH CORPORATION WATER SUPPLY.

A New Bill.

A Special Meeting of the Plymouth Borough Council was held last Wednesday, for the purpose of considering and determining upon the expediency of promoting in the next session of Parliament a Bill to authorize the construction of a new reservoir and other water-works, and in other respects to make better provision for the supply of water to the borough and neighbourhood, to borrow money, and to amend the various Acts relating to the water undertaking. The Chairman of the Water Committee (Mr. J. T. Bond), having read the preamble of the Bill, stated that the area of their present watershed, the rights of which were at that moment absolutely vested in them, comprised 4885 acres; but by the Bill before them, they intended to deal with an additional area of 475 acres. The height of the proposed dam was to be 74 feet; its length, 115 yards; and its proposed capacity, 497 million gallons. In connection with this, by the addition of some 10 feet to the wall of the dam, they could get a storeage capacity of 800 million gallons. The quantity of land required would be about 100 acres; and they would utilize about 40 acres which already belonged to them. The object of the reservoir was to preserve Plymouth against the ill-effects of drought in summer; and the not less disastrous effects of stoppage consequent on frost and snow in winter. Then they asked authority to construct a line of pipes, making a second channel for the supply into Roborough reservoir, and which line of pipes would be 4½ miles long, and 25 inches in diameter. The length of the leat would be 8 miles. By another clause of the Bill they were asking for a period of 10 years as the time during which the works should be executed. He was advised by responsible authorities that the work would be finished in half that period; but they wanted to be on the safe side. The time they proposed to take for the repayment of the money to be borrowed was 60 years; and as to the financial aspect of the scheme, he referred the Council to what was stated in March last. After the most careful review and reconsideration of the estimates, the Committee still adhered to the old figures. The total amount estimated to be borrowed was £150,000. They were also asking by a proviso to pay interest on the money during the construction of the work, and until it became productive. Whether Parliament would sanction that or not, they could not say; they could only quote as a local precedent Sutton Harbour. The Town Clerk remarked that they could also quote the case of Birmingham, in which Parliament gave consent last year. Mr. Bond then moved the necessary resolution, which was seconded by Mr. May, and, after a little discussion, was unanimously agreed to.

METROPOLIS WATER SUPPLY.

The Quality of the Water in September.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 196,716,742 gallons, as compared with 188,148,177 gallons in the corresponding month of 1891; being at the rate of 250 gallons to each service. Of the entire bulk of water sent out, 100,376,664 gallons were drawn from the Thames, and 96,340,078 gallons from the Lea and other sources.

Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; New River, 1·3; Tottenham, 1·5; Colne Valley and East London (deep well), 1·7; East London (river supply), 2·2; Chelsea, 2·6; Southwark, 2·9; and West Middlesex, Grand Junction, and Lambeth, 3·2. The untreated river waters gave the following numbers: New River cut, 1·9; the Thames at Hampton, 4·0; and the Lea at the East London Company's intake, 4·2. The Thames at Hampton was, chemically, of the same quality as in August; but the water delivered by the five Companies drawing from this source was somewhat inferior to that supplied in that month. Nevertheless, it was of good quality, considering the time of the year; and it was in every case efficiently filtered. The untreated water taken chiefly from the Lea by the New River Company was, chemically, of better quality in September than in August; and that actually delivered again ranked with the deep-well waters in respect of organic purity. The untreated water drawn from the same river, but lower down, by the East London Company, was inferior to the Thames at Hampton; but the water actually delivered by this Company was superior to any of the Thames-derived supplies. Both waters were efficiently filtered before distribution. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic use; that of the Kent Company being especially distinguished for its very high degree of organic purity. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, and East London (deep well) waters were clear and colourless; the New River, clear and nearly colourless; while the remaining waters were clear and very pale yellow. The crude river waters presented the following appearances: New River cut, turbid and very pale yellow; the Lea at the East London Company's intake and the Thames at Hampton, turbid and pale yellow. The bacteriological examination of the waters as they left the filters of the various Companies, by Dr. Koch's process of gelatine plate culture, gave the following results: One cubic centimetre of each water, collected on Sept. 12, 13, and 15, developed the following numbers of colonies of microbes: Kent (from delivery-shaft of pump), 3; New River, 3; Chelsea, 6; Southwark, filters Nos. 1 and 2, 6; do., filter No. 3, 272 (this filter was not yet in order, but it is satisfactory to find that the microbes had been reduced from 996 in August to less than one-third of this number in September); Lambeth, 8; East London, 9; Grand Junction, 10; and West Middlesex, 14. Of the untreated river waters, the New River cut developed 737; the Thames at Hampton, 947; and the Lea at the East London Company's intake, 1947 colonies of microbes per cubic centimetre."

Messrs. Crookes and Odling, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the past month, as shown by samples taken daily for analysis, state that, of the 182 samples examined, the whole were found to be perfectly clear, bright, and well filtered; the somewhat considerable rainfall on the 21st and 22nd ult. (amounting at Oxford to 0·76 inch) being without obvious effect on the subsequent supply There was also a fall of 0·71 inch on the last day of the month. In respect to the smallness of the proportion of organic matter present, the character of the water furnished by the seven Companies continued to be entirely satisfactory; the mean amount of organic carbon in the Thames-derived supply, for example, being 0·118 part, and the maximum amount in any single sample examined being but 0·145 part, in 100,000 parts of the water—numbers practically identical with those of the previous month, or 0·115 part for the mean, and 1·52 part for the maximum amount. As the above-named chemists have observed in previous reports, so long as the organic matter in the water supply, as estimated alike by the combustion and oxidation processes, continues absolutely small, the seasonal variations in amount are of no practical significance. With the coming on of autumn and winter, however, it is not to be expected, they say, that the low average of the past six months will be much longer sustained; this average, in the case of the Thames-derived supply, amounting only to 0·116 part of organic carbon in 100,000 parts of the water, with a maximum, twice met with, of 0·152 part in any individual sample. They close their report by pointing out that the water supply to London is habitually at its best during the hot season, when a high quality of supply is especially called for.

A Petroleum Syndicate.—Under the title of the Anglo-Galician Syndicate, Limited, an undertaking has been started, with a capital of £30,000, in £100 shares, to acquire land in Galicia or elsewhere, and sink wells thereon for the recovery of petroleum.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The stair-lighting question is again to the front in Edinburgh. It came before the Town Council on Thursday—first, as a request by a deputation of social reformers, who asked the Council to take powers in the Bill which the Corporation are about to promote in Parliament for the lighting and extinguishing by the Council's servants of lights on common-stairs, and then in a report by the Cleaning and Lighting Committee recommending the same thing. Lord Provost Russell opposed the proposal, on the ground that they had, under their Act of last year, power to do what was suggested, with the exception that they were authorized to charge the cost upon the owners of property and not upon the rates. He did not think a Parliamentary Committee would give them further powers till they had made an attempt to put last year's Act in force. It transpired in the course of the discussion, that the present powers of the Corporation apply only to those stairs upon which there is no outer door, and which in Edinburgh are very few; and that the desire of the Cleaning and Lighting Committee was to get powers to deal with all descriptions of stairs. The cost of the proposed arrangement, it was stated, was estimated at ½d. per pound on the rates. This was on the assumption that servants to do the work of lighting and extinguishing would be got at 12s. a week. I venture to say that men, or even lads, will not be got to do the work for that wage; and that, if the scheme were once established, it would soon mount up to, perhaps, 1d. per pound on the rates. I am, as I have written before, against the proposal altogether; because it requires one man to pay for the lighting of another man's private property. If the proposal were to undertake the lighting and extinguishing of the lights, and to charge the owners of property, I could support it. But I would like first to see a trial made of enforcing the present law; for I cannot recognize it as reasonable that those who are willing to do the duty themselves, should be compelled to pay for its being done by the Corporation. Mr. John Jamieson moved that the Corporation should also supply gas for the lights, and charge it on the rates; and Mr. Eunson, in seconding, made the astounding remark that "if there were to be free libraries, the same benefit ought to be extended to those living in common-stairs." Such an absurd proposal was not homologated by the Council.

The Stirling Town Council had the subject of acquiring the Gas Company's undertaking again before them on Monday last. Bailie Lawson, for the Lighting Committee, reported that he had called at the gas-works to ascertain the number of shares of the Company, and the producing capacity of the works; and that he was informed his request would be considered by the Directors. No reply had been received. A deputation had, however, been appointed to visit the gas-works at Dumbarton and Alloa, to obtain information. The Committee asked the Council to defer consideration of the subject to another meeting; and this was agreed to. The Council looks like business this time; and the Gas Company, I expect, will treat their proposals with the deference they deserve.

There was an action in the Dundee Small Debts Court on Tuesday which is of some importance to dealers in coke. A Glasgow firm sued a Dundee firm for £13 6s. 8d., restricted to £12, as damages for breach of contract in failing to take delivery of coke from Glasgow. The defence was that the coke contracted for was "best Glasgow;" but that what was sent was from the Dalmarnock works, and was of inferior description and unsuitable for such work as the heating of bakers' ovens. The pursuers maintained that all Glasgow coke was of the same quality—a contention which will not hold water, because the coke which results from the more scientific distillation of coal is of less calorific value than that produced by older methods. The Sheriff gave decree for only 21s., of which 16s. 8d. had been tendered for coke which had been accepted.

The Forfar Gas Corporation last year realized a deficit of £185, owing to the fall in the price of residuals and the break-down of their coal supply from Grange Colliery. For the current year, they have estimated an expenditure of £6150, which will, it is expected, still leave a deficit of £2 10s. The price of gas has been advanced from 4s. 4d. to 4s. 6d. per 1000 cubic feet.

The Corporation of Hamilton have taken up seriously the subject of lighting the town with electricity. On Tuesday, Mr. Arnot, the Electrical Engineer to the Glasgow Corporation, visited the town; and, in conjunction with some of the Magistrates and Councillors, and Mr. Ewing, the Gas Manager, inspected two sources of water power in the neighbourhood. A conference was then held in the Council Chambers, when the question discussed was whether water or steam power should be adopted. Mr. Arnot informed them that they might light their streets at a cost not much in excess of lighting by gas. He undertook, however, to prepare a report which would deal with the probable cost and the best method of carrying out a lighting scheme. The Corporation should take time; because the best report Mr. Arnot could give would be the results of a year's working of his own installation in Glasgow.

That is the attitude which is being taken in some places, and particularly in Edinburgh, where Lord Provost Russell the other day informed the electors of the Ward which returns him to the Town Council that "he was not such a great believer in the electric light as some people. Electric light was very expensive; and the Act was a very unfair one, forcing, as it did, every town to begin experimenting or allow a company to do so. The Council came to the conclusion that it would never do to allow a company to break up the streets of the city; and so they went in for a Provisional Order for themselves, as many other towns had done. It put them in the uncomfortable position, if it did not pay, of making up the loss from the rates; and not only so, but of assessing people for the loss who were not within the particular area supplied with the light. He was anxious not to begin the electric light installation until the last possible moment; for, having a year's longer grace than most other towns, Edinburgh would be able to profit by other people's experience." Setting aside the last sentence, which some people may take exception to as derogatory to the position which Edinburgh should take up, his lordship's remarks are the most sensible I have heard from any public man on the subject.

The inhabitants of Moffat met on Friday night to consider whether the Police Commissioners should proceed with an electric lightin scheme for the burgh. Provost Young read a report by Professor Jamieson, of Glasgow, which stated that the cost of works to light the streets and a limited number of houses would be from £2000 to £3000. The Provost pointed out that the introduction of the light would mea n an increase of from 3d. to 5d. on the rates. A majority of the ratepayers approved of the new light; so that another name has to be added to the list, short as yet, of small towns which have resolved to hang a millstone about their necks.

The realization of the estates of Mr. John Dobbie, of Leith, who was contractor for the residuals of a number of gas-works in Scotland, is not being effected without a good deal of trouble. Mr. Dobbie, it will be remembered, in February last granted a private trust-deed in favour of Mr. J. S. Tait, C.A., of Edinburgh; and it was understood that the creditors agreed to accept a composition. The trust arrangement seems to have broken; down for last month it was converted into a sequestration, granted by the Sheriff of Mid-Lothian. There was a competition for the trusteeship; but the Sheriff continued Mr. Tait in the office. Against his decision, several of the creditors took an appeal to the Court of Session; and their lordships of the First Division disposed of it to-day, when the Court confirmed Mr. Tait's appointment. He and Mr. Dobbie, according to the appellants, are at variance; and there will most probably be a severe examination in bankruptcy of Mr. Dobbie, when the whole of the facts may come out. Meantime, with legal points cropping up, the prospect of the creditors getting much of a return from the estate is not very bright, as it looks as if most of it will be gobbled up by the lawyers.

It is reported that the Dundee Gas Commissioners have under consideration a proposal to go to Parliament for extended borrowing powers, and for an alteration of the constitution of the Commission. The borrowing powers of the Commission are all but exhausted, which is not a comfortable state of matters to exist in. The constitution of the Commission is of equal importance, because at present several irresponsible bodies—such as the Guildry, the Chamber of Commerce, and the Incorporated Trades—appoint members to it. As a matter of fact, only seven out of 21 members are elected to the Gas Commission by the ratepayers; and it is felt to be desirable that the Town Council should have, if not the whole management of the undertaking, at least a preponderating voice in it.

A peculiar mishap, which may bear explanation, but which has not yet been accounted for, occurred at the Elgin Gas-Works on Monday. On the evening of that day, it was discovered that gas was not passing into the gasholder; and a search for the cause revealed the fact that a pipe, at some part of the works (not stated) between the retorts and the gasholder, was completely choked with pitch. Gas-making had to be stopped till the pipe could be cleared, a work which occupied Mr. Taylor, the Manager, and a staff of men, about 24 hours. The gas supply was exhausted at midnight on Monday; and the town was in darkness on Tuesday morning and night. The Gas Commissioners certainly ought to have such a serions interruption to the gas supply fully inquired into.

The debt of the City of Glasgow was increased during the past year by no less a sum than £817,250. This was due to the acquisition of the Partick, Hillhead, and Maryhill Gas Company's undertaking and the extension of the city boundaries. To meet the debt, temporary loans were first arranged, at interest varying from 2¾ to 3 per cent. The arrangement was not, however, considered satisfactory; and at Whit-Sunday last, the Corporation created additional 3½ per cent. redeemable stock to the amount of £750,000. The stock was very largely over applied for; but the premium realized was only £1146.

When I spoke last week of holding over reference to the subject of the water supply of Glasgow, I had in my mind's eye chiefly a charge which it has pleased Mr. Labouchere, M.P., in his capacity of general critic of all public and private affairs, to allow a correspondent to bring against the quality of the water as delivered from Mugdock reservoir. This was to the effect that two fields adjoining the reservoir were manured with the fulzie of the town of Glasgow; that the fields were drained into the reservoir; and that the water, in consequence, was more impure than some which is supplied in London. The charge has been most stoutly denied by the members of the Corporation in their addresses to the electors. Mr. Councillor Osborne, who has been connected with the Water Committee of the Town Council for thirty years, described it as "a pure downright romance." Both the fields, he stated, were drained into streams; and not a drop of the drainage found its way into the reservoir, which was so completely protected, that no drainage from any of the fields in the surrounding district could find its way into it. He admitted that there were impurities in the Glasgow water; but they were, he said, from vegetation only, and were perfectly harmless. Other Councillors have contradicted the statement, on the authority of Mr. J. M. Gale, the Engineer to the Glasgow Water Trust. Mr. Labouchere's correspondent has repeated the charge since it was contradicted; but no notice has been taken of it this week.

Proposed Augmentation of the Water Supply of Coventry.—A long discussion took place at the meeting of the Cove[illegible] C Council last Tuesday week, on a report by the Water C[illegible] which it was recommended that permanent pumping mach[illegible] should be put down at Whitley, where borings for additional water have been made. The proposal was opposed by Mr. Andrews, who suggested that a supply should be drawn from the Upper Sherborne Valley, because, he believed, plenty of water was to be found there, and because there was danger of contamination at the other end of the city. He moved an amendment in accordance with his remarks; and this Mr. James seconded on the grounds of economy. Alderman Marriott said the Council had put themselves in the hands of Mr. Hawksley, who had pledged himself to the Whitley scheme. Alderman Read, the Chairman of the Water Committee, combatted Mr. Andrews' position; and Alderman Tomson said the amendment came to this, that the Council were to abandon all the works they had already carried out at Whitley. Ultimately the Committee's report was passed.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 22.

Sulphate of Ammonia.—The market is without change; and there will apparently be no alteration in the position for some time to come. The present demand is equal to the production; and although one hears a good deal about lower prices, buyers are not shy in picking up parcels readily. There is considerable forward inquiry from consumers; and, although they will not at present exceed spot values, their intentions must give a favourable impulse to the market. To-day's quotations are £10 to £10 1s. 3d. at the ports, and only a limited quantity offering. Nitrate is rather strong in tone.

LONDON, *Oct.* 22.

Tar Products.—Pitch continues firm; and important shipments are being made. There has probably never been a time in the trade before, when stocks in makers' hands were so small as they are to-day; but with the present low and drooping price of coal, it is too much to hope that the price of pitch will be maintained. There is more doing in creosote and other tar oils; but prices are wretchedly low. Carbolic acid is in demand; but buyers are offering less money. Anthracene is slightly firmer; but whether this is due to better demand, or to the reluctance of makers to sell, remains to be seen. Benzols are sick; and the outlook for them is not encouraging. Business has been noted at the following prices: Tar, 10s. Pitch, 27s. 6d. Benzol, 90's, 1s. 7½d.; 50's, 1s. 4d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1½d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1⅜d. Creosote salts, 20s. Pressed naphthalene, 45s. Carbolic acid, 60's, 1s. 2½d.; 70's, 1s. 6d.; crystals, 5½d. Cresol, 10½d. Anthracene, 30 per cent., "A" quality, 9d.; "B" quality, 7d.

Sulphate of Ammonia.—There appears to be a determined effort to depress this article. It is admitted on all sides that what is made is required; and taking into account the nitrogen value of its competitor nitrate of soda, there is no reason why the price of sulphate should go lower. Transactions are said to have been made at as low a price as £9 18s. 9d.; but £10, less 3½ per cent., is to-day's average value. Gas liquor (10-oz.) is quoted at 6s. to 7s. per ton.

COAL TRADE REPORTS.

Lancashire Coal Trade.—The condition of the coal trade generally throughout this district continues without any very material change. In isolated cases, slight advances have been made, where quotations have been reduced during the summer months; but generally, current rates are practically unchanged. At the pit mouth, best Wigan Arley can still be bought at 12s. to 12s. 6d.; Pemberton four-feet, and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 8s. 6d. to 9s. per ton. Common round coals continue a more or less drug all through; and except where such reliefs can be obtained by increased requirements for house-fire consumption, there is no prospect of improvement in this branch of trade. The demand for iron making and other manufacturing purposes is, if anything, decreasing; whilst for shipment, business also continues unsatisfactory. At the pit mouth, ordinary steam coal is quoted at 7s. 6d. per ton; but to effect sales of anything like quantities, extremely low figures are frequently quoted. For shipment, although 8s. 6d. to 8s. 9d. represents about the average figures for good qualities of steam coal, delivered at the ports on the Mersey, there have been sellers in the market at as low as 8s. per ton. Engine classes of fuel are gradually becoming more plentiful in the market, with supplies from outside districts offering at very low figures. So far, however, quotations of Lancashire collieries are being fairly well maintained; and still average 6s. to 6s. 3d. for burgy, 5s. to 5s. 3d. for best qualities of slack, 4s. to 4s. 3d. for medium, and 3s. 3d. to 3s. 6d. for common sorts.

Northern Coal Trade.—In the coal trade of the North, there have been heavy arrivals of steamers, which have given activity to many collieries, and rather stiffened the prices. These changes will now occur more or less in the winter. Best Northumbrian steam coals are steady at about 9s. 6d. per ton f.o.b.; but where trade is dull, discount is allowed from that price. For second-class coals, about 9s. per ton is asked. Small steam coals are abundant, at from 3s. 6d. to 4s. per ton. For bunker coals, the demand is rather easier; and the price varies from 7s. per ton for unscreened up to 9s. 6d. for best Durham screened. Household coals are quiet; and one or two of the collieries have reduced the high price of this class of coals. In the gas coal trade, there is now much more activity—the demand being enlarged, especially for the great gas companies in the South, whilst full work for two months is tolerably certain. The miners at the Durham collieries are now working very well, and the production is adequate; so that the effect on the prices is less than it would otherwise have been. As low as 7s. 3d. per ton f.o.b. has been quoted in one or two instances; but the collieries which ship at the Wear seem to have their output more fully contracted for, and they ask 7s. 6d. to 8s. per ton for such odd cargoes as they have to sell. Manufacturing fuel is only in moderate demand; and contracts taken are at reduced prices. Coke is firm for blast furnace qualities, at 13s. 6d. per ton delivered at the local furnaces. For export, 15s. to 16s. on board is asked. Gas coke is unaltered in price.

Scotch Coal Trade.—The trade in Scotland this week has been featureless. Shipping still keeps up as compared with last year; but the home demand is very slack. The men have sufficient sense to realize that times are looking bad; and for the present, agitation is not in their head. They are working steadily—much more so than when trade is good. They can, however, but command four days' work a week; and even with that, in some instances, stocks are accumulating. Foreign inquiry has fallen off, which is giving some concern to coal-owners. Quotations do not show any change; but it is an open secret that orders will be accepted by many below the recognized figures. That is particularly the case with gas coal, for which there is now very little demand. Last week's prices may be given with the above explanation. The shipments for the week were 164,053 tons—a decrease of 5877 tons upon the preceding six days, but an increase of 20,702 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,053,113 tons—an increase of 721,770 tons over the same period of the previous year.

Electric Lighting for Bristol.—The Electrical Committee of the Bristol Corporation have had before them eight tenders for the building of the proposed electric light station; and they have selected one sent in by Mr. C. A. Hayes, amounting to about £13,000.

Conviction for Stealing from the Rochester Gas Company.—On Monday last week Frederick Charles Abbott, of the firm of Messrs. Abbott Brothers, yacht builders, and lately in the service of the Rochester Gas Company as clerk, was sentenced at Rochester to six months' imprisonment for embezzling money belonging to the Company. It was stated that his defalcations amounted to £260.

The Electric Lighting at the Chicago Exhibition.—The building and grounds of the Chicago Exhibition are to be lighted by 5000 arc, and 93,000 incandescent lights; there being 17,000-horse power provided for the lighting, out of the 24,000-horse power in the machinery building. This is ten times the quantity of electric lighting power provided at the last Paris Exhibition; the whole electrical plant costing £200,000.

The Embezzlement by a Collector of the Kendal Gas and Water Company.—At the Westmorland Quarter Sessions, at Kendal, last Friday, Marcellus Thompson was charged with embezzling certain sums of money, the property of the Kendal Gas and Water Company. The prisoner, who belongs to a well-known and respected family, had been in the employment of the Company over 20 years; and so great was the Directors' faith in his honesty that no bond was required. The full amount embezzled was £4230. After a long hearing, the prisoner was found guilty, and sentenced to three years' imprisonment.

Petroleum Engine Company, Limited.—The Directors of this Company, in their report for the year ended June 30 last, state that the accounts show that the royalties received for that period amount to £1629. The increase in the royalties earned took place largely in the two last quarters of the year; showing that the steady increase in the number of engines sold is continuing in a satisfactory manner. The amount standing to the credit of revenue account, including the amount brought forward from last year's account, is £1197. The Directors recommend the declaration of a dividend on the 18,754 shares at the rate of 1s. per share, free of income-tax, for the past year; leaving a balance of £236 to be carried forward.

The Water Supply of Bradford Out-Townships.—The Calverley Local Board have decided to accept the offer of the Bradford Corporation to supply their district with water for a period of twenty years. Farsley having also arrived at the same decision, the water supply of these two districts will in both cases pass out of the hands of a private Company to the two Local Authorities, who, along with Pudsey, have jointly purchased the plant of the Company. Both Calverley and Farsley will be supplied principally from the low-level system of the Corporation; and what small portions of each district cannot be reached, can be easily supplied from the high-level system, as the pipes from both pass through parts of the districts.

The Proposed Water-Works Extensions for Leeds.—On behalf of the Local Government Board, Mr. Thos. Codrington held an inquiry at Leeds, on the 4th inst., into an application by the Borough County Council for sanction to borrow £131,600, of which £100,000 is required for water-works extensions and £31,600 for general improvements. The Town Clerk (Mr. J. Harrison), in laying before the Inspector the reasons for the application, stated that it was based on the Provisional Order of 1888, under which the Corporation were empowered to borrow £200,000 for water-works purposes, in addition to £100,000 for which powers had been previously granted and exhausted. In February, 1890, an inquiry was held, upon the application of the Corporation, for sanction to borrow, among other moneys, a sum of £200,000 for water-works purposes authorized by the Provisional Order of 1888. It was afterwards considered that it would be sufficient to apply for £100,000 only; and, upon the Inspector's report, the necessary permission of the Local Government Board to the borrowing of that amount was granted—£70,000 being repayable in thirty years, and £30,000 in forty years. Sanction was now sought for the borrowing of the remaining £100,000, which would exhaust the powers under the Order of 1888 for water purposes. The Corporation had provided a magnificent system of water-works; but the consumption of water had so largely increased that further extensions were an absolute necessity. In 1881 there was an average daily consumption of 7,858,000 gallons; while in 1891 it had reached 12,946,000 gallons—an increase of more than 5,000,000 gallons daily. The £100,000 which it was now sought to borrow was intended to be applied in the ordinary and necessary extension of mains arising out of the increased demand for water, in the enlargement of the Eccup reservoir, and reconstruction of the embankment, in the extension of the reservoir at Moortown, in providing a new service reservoir at Harehills, and in other necessary and consequential works. The Borough Surveyor (Mr. T. Hewson) explained in detail the various works in respect of which the present application was made. With reference to the Eccup reservoir, he gave the Inspector information as to the history of the leakage, and the steps that had been taken to remedy it. Already 147 yards of the trench had been dealt with, at a cost of about £26,512; and on this basis, the Corporation asked for £25,000, the estimated cost of the additional length of 140 yards that was proposed to be taken in hand. The Borough Accountant (Mr. Derry) mentioned that the total cost of the Eccup reservoir up to March 25 last was £195,450, including the cost of works in connection with the reconstruction of the Eccup embankment. Mr. Hewson further stated that it was proposed to double the present capacity of the Moortown reservoir, which was used for the supply of the high-level districts. The estimated cost of this extension was about £5000. The details of the proposed general improvements were afterwards dealt with.

Alterations at the Halifax Gas-Works.—During the past summer, the retort-houses at the Halifax Corporation Gas-Works have been almost entirely rebuilt and adapted to the employment of machinery. The canal-boats conveying materials to the works are now emptied by a patent elevator; and the coal is carried, by means of a series of leather bands, to the exact spot where it is required.

Water Supply Scheme for Standish.—A scheme for supplying the district of Standish (near Wigan) with water has lately been inaugurated with some ceremony. The district has hitherto been dependent on wells; but the Local Board have now entered into an arrangement with the Liverpool Corporation by which an adequate service is obtained from the reservoirs at Rivington. The cost of the works has been about £12,000; and the result is to ensure an ample supply and abundant pressure in every part of the district. Standish is included in the district which Manchester acquired powers to supply under their Thirlmere Act; but, on the present scheme being proposed, the Corporation surrendered their rights. The water was turned on by Mr. W. H. Hewlett, Chairman of the Local Board, who was presented with a silver goblet as a memento of the occasion.

Gas and Electric Lighting at Belfast.—The Corporation of Belfast held a meeting in Committee last Thursday week to receive a report prepared by a Committee appointed to consider the questions of the electric lighting in the city and the site for the new gas-works. With respect to an electric light installation, the Committee stated that there had been many reasons to render it undesirable to hasten the undertaking of any definite system, having regard to the great diversity of opinion among experts as to the best one to adopt. They were, however, of opinion that the time had arrived when an installation capable of supplying (say) 10,000 incandescent lights, and of future extension if found desirable, should be undertaken; and they recommended that the services of an electrician should be obtained to advise as to the best system and the best method of procedure. As regarded the gas-works, the Committee were satisfied that, notwithstanding the introduction of electric lighting, an extension of the works was urgently required. They were also of opinion that only two sites were eligible for the purpose—viz., the one originally proposed on the low-lying ground of Ormeau, and the other on the lands of Glentoran. The Committee considered that, for the purpose of ascertaining the views of the ratepayers as to which of these sites should be taken, a circular should be issued giving particulars, and requesting them to intimate their views thereon for the guidance of the Council. In any case parliamentary powers would be required. The report was adopted.

Buxton and the Electric Light.—The Buxton Local Board had before them, at their meeting last Friday week, a batch of correspondence relating to the subject of electric lighting. It appeared that 150 circulars had been sent out to ratepayers to test their feeling on the question. There were only 35 replies—15 of the writers stating that they would not be disposed to adopt the light, and the remainder could not say how many lights they would require until they knew the cost. In opening a discussion on the matter, Mr. Cooper said they had a capital of £48,000 sunk in the gas-works; and it was a concern that was paying its way. There were 17 miles of gas-mains, 1113 consumers, and 348 public lights. The total receipts last year were £10,439; and after paying off interest on loans, repaying principal, and meeting all expenditure on the works, the net profit was £636. He held that it was not wise to throw cold water on a certainty for an uncertainty; and he defied any member of the Board to prove that there was any local authority or corporation who had taken this matter of electric light in hand and could show a profit. The ultimate result would be that the price of gas would go up. Where the light was adopted, they had to fix street-lamps of 1000-candle power, and this meant money to keep them going. Mr. Lawson remarked that they would be obliged to take up the matter themselves or some outside company would be asking for powers. Mr. Herford combated Mr. Cooper's remarks, and said their own Gas Manager (Mr. G. Smedley) distinctly stated that the use of the electric light did not lessen the consumption of gas. Three or four other members spoke in opposition to the adoption of the electric light; and, after the Chairman (Mr. Milligan) had remarked that, when they got into the £ *s. d.* part of it, and considered the question calmly, they would be able to know whether they could afford it, the discussion was adjourned.

The Scottish Mineral Oil Industry.—The difficulties which beset the Scotch mineral oil industry, of which a good deal have been heard of late, has given rise to the belief that it can no longer compete successfully with America and Russia. A correspondent of the *Glasgow Herald*, however, takes a more hopeful view of the future of the industry. By improved processes, the people engaged in the Scotch trade have in 20 years reduced their cost of products from 1s. 1d. to about 4d. per gallon. Owing to their having to mine the shale at a cost of from 4s. 6d. to 5s. 6d. per ton, and thereafter to distil it so as to convert it into crude oil at a cost of (say) 2d. to 2½d. per gallon, while the American producers obtain their oils almost free of cost and charge, the former are placed at a considerable initial disadvantage. But the benefits are not all on the one side. The American burning and heavy oils have accompanying them no ammonia; and the quantity of paraffin scale yielded in America amounts only to from 1 to 2 per cent. On the other hand, the Scotch companies, from improved retorts, realize from 22 to 60 lbs. of ammonia from each ton of shale; while the proportion of scale varies, according to the shale, from 11½ to 16 per cent. As the yield of ammonia in some cases pays the total cost of raising the shale, and the price of solid paraffin, even in its crude form, is nearly six times that of burning and heavy oils, the Scotch industry from these two items alone has advantages as compared with America and Russia; the latter country having neither ammonia nor scale. The hope for the Scotch industry lies in a further reduction of costs and improvement of plant and processes. As to the costs, coal is becoming cheaper; and as the trade consumes 700,000 tons per annum, that is a considerable item. Materials such as vitriol and caustic soda are tending downwards, and wages are being reduced. Altogether, in the next financial year, the costs will probably revert to those of 1888-9. As to processes, there is reason to hope for further improvements and economies; and there is the prospect of shale oil being largely used as an enricher of coal gas.

The East London Water Company and the Fencing of Lammas Lands at Leyton.—A few months ago there was quite a little war at Leyton, between the inhabitants and the East London Water Company, because the latter had fenced in certain lammas lands in the parish. The aggrieved parties, led by a member of the Local Board, demolished the fences; and the result of this proceeding has been the commencement of an action against the gentleman in question (Mr. Musgrave) and a Mr. Humphreys. A Committee has been formed with the object of raising a subscription to defray the cost of defending the action; and assistance will also be sought from the Commons Preservation Society.

Fires Caused by Electricity.—At Nancy a short time ago, a fire caused by an electric light wire occurred at the railway station, doing damage to the value of 50,000 frs.; and a few days afterwards, another, which was fortunately quickly subdued, broke out at a large stores in the Place St. Jean in that city. At Rouen, the Cathedral was lately endangered by an outbreak of fire in the sacristy, which is situated under the library and the treasury. The contact of two electric wires caused a gas-pipe to melt; and the escaping gas became ignited, and set fire to a beam. Luckily the light was noticed; and a few buckets of water, promptly applied, prevented any serious damage being done. But there was naturally much commotion in the neighbourhood of the venerable building.

Glenboig Union Fire-Clay Company.—The report of the Directors of this Company for the year ending Aug. 31 last shows that, including £2485 brought from the previous year, there is a credit of £6303, from which there has been written off for depreciation £2000, leaving a net profit of £4303. From this it is proposed to pay a dividend of 2½ per cent., less income-tax. This will absorb £3375, and leave a balance of £928 to be carried forward. The Directors state that the general depression of trade, and consequent reduction of prices, have operated now for some time against the realization of satisfactory profits. During the year just ended, wages have been higher and selling prices lower than since the formation of the Company. With diminished costs, however, even should the present depression continue, better results may not unreasonably be anticipated.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 720.)

Issue.	Share	When ex-Dividend.	Dividend or Bonus.	NAME	Paid per Share	Closing Prices	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17*	+½	6 3 6
100,000	10	,,	7½	Do. 7 p. c	10	10½—11¼*	..	6 10 5
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
100,000	20	27 May	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6—6½	..	5 15 9
40,000	5	,,	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	212—217	..	5 10 7
150,000	,,	,,	9½	Do. New	100	163—168	..	5 10 1
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	31 Aug.	5	Bristol.	100	102—107	..	4 13 5
320,000	20	29 Sept	11½	British.	20	42—44	..	5 2 3
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	,,	—	Buenos Ayres (New) Limited	10	7—8	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	95—100	+½	6 0 0
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	14 Oct.	13	Commercial, Old Stock	100	231—236*	..	5 10 2
165,000	,,	,,	10	Do. New do.	100	179—184*	..	5 8 8
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 4
800,000	Stck.	15 June	10	Continental Union, Limited	100	227—232	..	4 6 2
200,000	,,	,,	7	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	19½—20½	—½	4 17 7
354,060	10	,,	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	215—219	—½	5 9 7
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	257—262	..	3 16 3
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 7
80,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171	..	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	162—167	..	4 3 10
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	255—260	..	3 16 11
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	150—154	..	3 17 11
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	118—121	..	3 6 1
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—127	..	3 10 10
908,000	,,	,,	6	Do. 6 p. c. do	100	164—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	228—231	..	5 3 10
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	106—108	..	4 12 7
541,920	20	15 June	5	Monte Video, Limited.	20	14—15	..	6 13 4
150,000	5	27 May	10	Oriental, Limited	5	8½—8¾	..	5 14 3
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	—	2	Pará Limited.	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds..	100	106—110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100—103	..	5 16 7
150,000	10	—	10	San Paulo, Limited	10	9¾—10½	+½	—
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	280—290	+5	5 6 11
1,350,000	,,	,,	12	Do. B do.	100	230—235	..	5 2 1
230,000	,,	,,	13	Do. C do.	100	240—245	..	5 6 1
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140—144	..	3 9 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	245—250	..	4 0 0
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	197—202*	..	3 19 2
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	140—144	..	3 2 6
700,000	50	1 July	8½	Grand Junction	50	103—105	+1½	4 0 11
708,000	Stck.	12 Aug.	11	Kent	100	263—268	+1	4 2 1
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	215—220	..	4 6 4
406,200	100	,,	7½	Do. 7½ p. c. max.	100	190—194	..	3 17 3
279,700	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	122—125	..	3 4 0
500,000	100	12 Aug.	12½	New River, New Shares	100	320—330	..	3 13 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	128—132	..	3 0 7
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	147—150	..	4 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	134—138	..	4 14 3
1,155,066	Stck.	15 June	10	West Middlesex.	100	240—245	..	4 1 7

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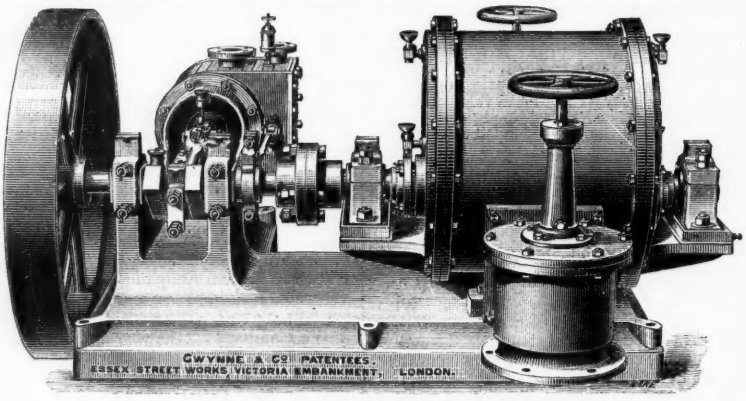

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Tenders for Tar to be addressed to me not later than the 31st of October.
JOHN A. HARRIS,
Engineer and Manager.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at their Neepsend and Effingham Street Stations, during the next Twelve Months.
Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered by post, addressed to the undersigned, not later than Saturday, Nov. 5 next.
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Oct. 12, 1892.

TO IRON ROOF MANUFACTURERS, ETC.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the construction of an IRON ROOF, 246 feet long by 60 feet wide, with Columns and Girders to carry the same, to cover a portion of their Coal Sidings.
Forms of Tender with Bill of Quantities may be obtained, and the Drawings may be seen, upon application to the Engineer, Mr. Fletcher W. Stevenson, at the Company's Offices, Commercial Street.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Iron Roof," and addressed to the undersigned, must be delivered at the Company's Offices by post not later than Monday, the 7th day of November next.
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Oct. 12, 1892.

Price 2s. per dozen, or 10s 6d. per 100, post free.

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Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
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[See also Advt. p. 716.

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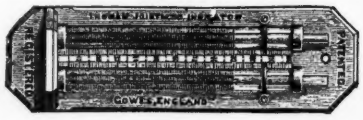

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Compiled and arranged by **ALFRED LASS,** Fellow of the Institute of Chartered Accountants.

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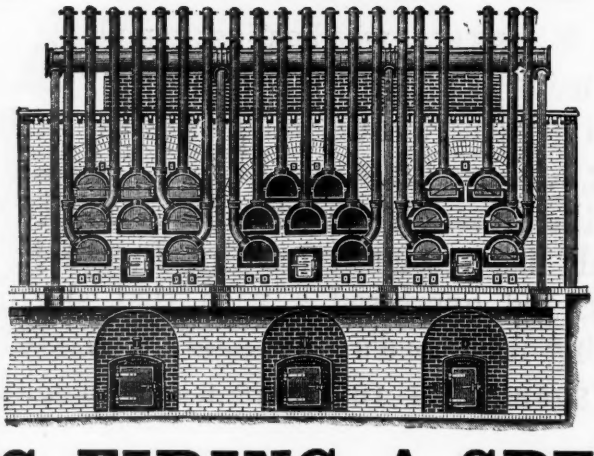

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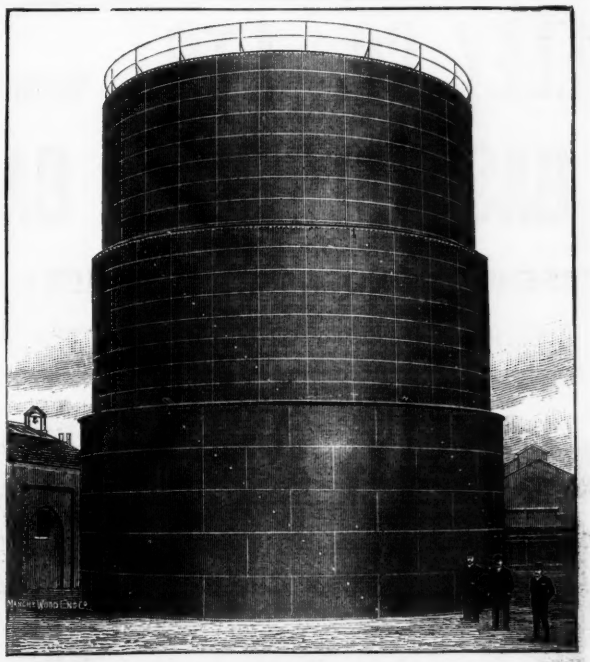

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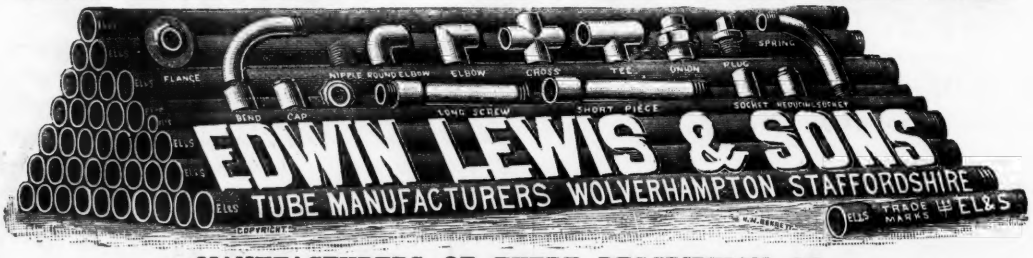

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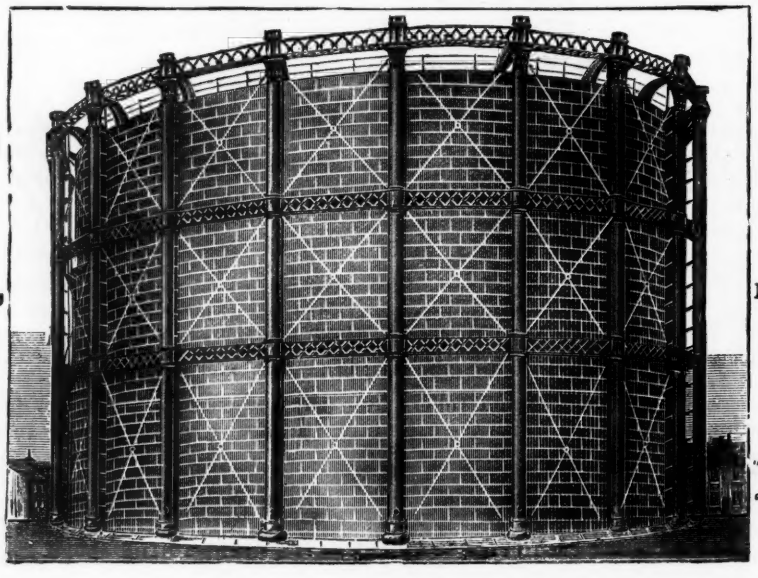

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For Illustrated Description, see JOURNAL, Aug. 23, p. 346.

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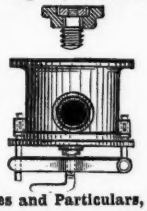

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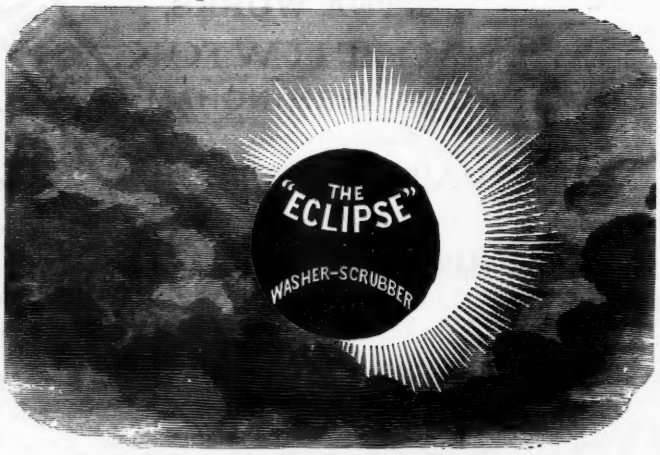

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